A CASE STUDY ON THE IMPLEMENTATION OF TOTAL QUALITY MANAGEMENT IN A PROJECT MANAGEMENT ORGANIZATION

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ABSTRACT

This project is a case study on the total quality management practice in an electric power utility company in Hong Kong. Particular reference is made to a pilot improvement team under a project department in the company, with an objective to establish understanding of the TQM practice in a multi-project management organization setting; the major issues of concern; and the implication which can be generalized toward similar quality management applications.

Literature review is carried out concerning quality management practice in general, based on the publications of proficient quality gurus and the publicized experiences of the total quality management in some U.S. utility companies.

The approach to the case is mainly through study of relevant company documentation, interviews with the employees in particular the members of the pilot improvement team, and non-interfering observation of the team process.

The case findings reveal that, on a philosophical basis, the overall TQM program of the subject company exhibits varying degree of adherence to Deming's Fourteen Points. Stronger adherence is apparent in the areas of management commitment, training programs, and inter-departmental quality effort, than the areas which require a long term systemic and cultural development, as can be expected in the early stage of the "learning curve" in any quality program.

The implementation framework of the subject TQM program manifests some of the concepts advocated by Juran, Crosby, Feigenbaum and Ishikawa, in terms of vision and mission formulation, organization set-up, training, cross-functional team-work and process improvement approaches.

The pilot improvement team, formed under the project department of the company, demonstrated the application the TQM approach to reduce project costs, with solid results. The approach is particularly relevant to a multi-project environment, in terms of cross-functional team-work, application of simple but effective quality tools, thorough coverage of relevant factors, and long term implementation of results through standard setting.

An important implication as derived from this case study is that a TQM program has to have totality in three domains, namely the organization domain, the process domain and the time domain, in order for it to be deeply rooted, far reaching, long lasting and producing desirable results. Most of the findings of this study are not only applicable to a public utility company, but can be generalized to other enterprises.

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CHAPTER I

INTRODUCTION

Throughout the decade, quality of products / services and customer satisfaction have become highly popular organizational goal and corporate strategy in many organizations in most parts of the world. This is particularly pronounced in the western countries, who have had very hard time in coping with the "economic invasion" from Japan.

For many years in the 1960's, Japanese products were associated with bad quality imitations. In the last twenty years, however, they have risen to become top of market rivalries, in terms of quality, state-of-art technology, and reasonable pricing. Many learning delegates and missions from the leading western industries have visited Japan, and many of the Japanese management gurus have been invited to lecture aboard, and their works got translated into many foreign languages and became world's best sellers. Amongst the various attributes, the dedication of the Japanese to the total quality concept is believed to be the main key to their success.

Japanese learned the American way of quality control along with the process of rebuilding their industries, which were completely devastated after their defeat in the Second World War. It was strictly a voluntary movement, not by the command of the government. The historic starting point was when the Union of Japanese Scientists and Engineers (JUSE) invited Dr. W. E. Deming of

the U.S. to lecture on statistical quality control in 1950, and was followed by similar seminars by Dr. J.M. Juran, also from the U.S.

It was therefore frequently cited that the quality practice which had such a dramatic success in Japan was originated in the U.S., used mainly by the defense industries during the Second World War. But ironically, such practice has met so little popularity after the War on its homeland, that it needed to be subsequently learned back from its importer.

Now the quality messages have traveled far and wide. Most producers and services providers in many parts of the world will find themselves having to address harder and harder the quality aspects, in order to keep their competitive position, in both export and domestic markets.

In Hong Kong, the impact of such quality drive is becoming more and more pronounced, largely due to the demand of the overseas markets, trading partners and / or business headquarters. Along with the internationalization of the quality standard under ISO 9000, many industrial and commercial undertakings in Hong Kong are trying hard to set up or modify their quality control system to line up with the international requirements. Many such undertakings do not only try to incorporate system which will improve their direct output in short term, but also develop overall program which will help to establish long term performance on a corporate basis. Total Quality Management (TQM) has become increasingly popular, in both private and public sectors. China Light & Power Co. Ltd. (CLP) is one of the public utility companies in Hong Kong pursuing quite actively the TQM program.

Basic Organization of this Project

This project is a case study on the TQM practice since its introduction to CLP, with particular reference to a line department which handles multiple capital development projects, associated with the electricity transmission system of CLP. The aim of the study is to establish understanding of the TQM process as it is applied to a project organization setting, and its impact on the ways of doing things in that organization.

This project report is organized into six chapters. Chapter One is the Introduction, which provides the general background of the subject.

Chapter Two describes the methodology used. It outlines the basic scope and approach of the study, together with some observations about the subject matter, based on a preliminary literature search.

Chapter Three is a review of the relevant literature. It makes reference to the publications of a number of proficient quality gurus. Some examples of the TQM practices in the U.S., in particular those of the utility companies, are included, to provide more solid insights about the subject matter.

Chapter Four covers the important findings of the study. It starts by briefly describing the course that TQM is being introduced and practiced in CLP and its overall impact on the company. Major part of this chapter is devoted to the experience of the subject department - Transmission Projects Department, concerning the implementation of the TQM concepts and the relevance to the way that project work is being handled by the department.

Chapter Five discusses the findings of the study. Discussion

will be centered on the TQM experience of the subject department, drawing comparison with the concepts covered in the literature review of Chapter Three.

Chapter Six provides a conclusion.

The Case Background

CLP was incorporated in Hong Kong in January 1901, less than 20 years since the first electricity generating station was commercialized in London in 1882. The growth of CLP was very closely tied with the development of Hong Kong, as detailed in N. Cameron's book - "Power, the story of China Light".

Since incorporation, CLP has been dedicated to the business of electricity supply. The supplying area of CLP now covers the whole Kowloon Peninsula, the New Territories, Lantao and several other outlying islands, and the southern part of Guangdong Province of China (including Shenzhen Economic Zone and Shekou Industrial Region). Appendix 1 shows the supply area of CLP.

CLP owns all its electricity transmission and distribution assets, while the electricity generating assets are owned jointly with an U.S. company, Exxon Energy Ltd. CLP now generates electricity in its Tsing Yi, Castle Peak and Penny's Bay Power Stations. By the middle and late 1993, two more generating sources will be commissioned to CLP's supply system - the Guangdong Pump Storage Power Station near Guangzhou, and the Guangdong Nuclear Power Station at Daya Bay, Shenzhen. Some general data about CLP are contained in Appendix 2.

The electricity demand growth in CLP's supplying area is estimated to be at a rate of 6% per year. To meet such a ever-

growing demand, new generating sources and associated transmission and distribution systems are needed to be planned and invested in. Another new power station on CLP's drawing board is the Black Point Power Station, being planned for 1996 commissioning, at the north-western coast of the New Territories.

As a public utility company, CLP's operation is subject to a Scheme of Control (SOC) agreement with the Hong Kong government, which regulates CLP's profit derived from electricity sales and specifies the service requirements in broad terms. The SOC agreement has just been renewed in June, 1992, granting CLP another 15 years of franchised operation on a regulated basis.

Although CLP's business is monopolistic in nature, yet ever-increasing pressure has been felt from various sources, such as the government, the investors, the social pressure groups, and the public at large. Simple quality target such as secure and adequate electricity supply nowadays serve only to fill a minimum part of the expectation list of the "service recipients". Adding to the list are quick and responsive services, technically and financially sound development plan, highly motivated and productive work-force, safe and environmentally acceptable installations and many others.

Coupled with the above is the impact of the internationalization of quality standard under ISO 9000 and its growing popularity in Hong Kong, the strong quality message from CLP's partner from the U.S., and the highly successful stories of quality movement of our neighbour -Japan, who is amongst the major equipment suppliers of CLP. All these attribute to the decision by CLP top management to apply TQM in a corporate scale.

The Transmission Projects Department (TPD), which is the

subject of this study is one of the fifteen departments of CLP. The main function of the department is concerned with the engineering and implementation of the capital development projects associated with the transmission network of CLP. As a line functional unit in control of a significant proportion of capital outlay of the company, TPD is amongst the front line subjecting to appreciable impact due to the TQM drive. In fact, one of the earliest TQM pilot teams was set up in TPD in March, 1992, which is chartered with a task of finding ways to cut down the projects costs.

CHAPTER II

METHODOLOGY

The main theme of the case study is one regarding the application of TQM to a project management organization. The primary focus is upon the quality management processes, and the key issues related to these processes, with the purpose of understanding TQM experience in a real life situation.

While there is relatively large collection of theories and propositions as regards how TQM is applied in the manufacturing and service organization settings, the TQM operations in a project organization setting has room for more detailed exploration. This is particularly relevant when there are mega-size construction projects about to take place in Hong Kong, associated with the Port and Airport Development Scheme. Quality will be made one of the core project requirements.

Basic Scope of the Study

The basic scope of the study is concerned with one particular department in CLP, viz. the Transmission Projects Department, and in particular, the TQM effort of the Pilot Improvement Team. However, since TQM practice is system-wide in nature, it is necessary for some of the issues to be addressed from the corporate perspective.

Due to the fact that the TQM is an on-going program as far as CLP and the subject department is concerned, the study is not one trying to find out how successful the program is. Instead, the study

will focus on some of the processes, basically to answer, if possible, the following questions :

1. How TQM is being practiced in a multi-project management organization setting?

2. What issues are being addressed?

3. What results have been produced and the associated impact?

4. How the above issues and results can be generalized into some implications concerning future and further TQM effort?

Basic Approach

The basic approach used for data collection and fact finding is a combination of review of the archival documents, unstructured interviews and non-interfering observations.

The interviews are aimed to cover different levels of employees of the project department being studied, as well as those from the other parts of CLP, which have working relationship with the project department.

Observations are made on some of the operation of the Pilot Improvement Team and the other activities of the department which are relevant to the case. Document search is also conducted to enhance the understanding of the case and to provide evidence in support of or to complement the interviews and observations. The observations and document search are to take place with no interference to the process or the situation being studied.

The data collected will be reviewed in the context of their contribution to the understanding of the situation and the process, as well as their relevance to questions as put forth above.

Confidentiality

Since the case is a real-life one, it cannot be avoided that some confidential data will be encountered. In such cases, the data will be quoted or extracted in part for illustration or for evidence, without disclosing the source.

Preliminary Literature Search

Preliminary search on the written works revealed that the term quality is very often attached to products and services providing activities and undertakings. Researches are in place as regarding the causal investigation of certain quality management practices, for example, upon productivity; or the development of instrument for measuring effectiveness of these practices.

Whereas quality management practices are fairly well covered for product / service sectors, there are relatively few coverage of such practices in the field of project management. It is an objective therefore, for the present study to ascertain the particulars about the quality management practices in a project management organization, and to find out more about the problems and difficulties, if any, in assessing the quality performance, and to compare them with those covered by the prevailing literature.

CHAPTER III

LITERATURE REVIEW

In 1986, the International Organization for Standardization (ISO) published an international standard ISO 8402, titled "Quality - Vocabulary". In the following year, the ISO 9000 series of standard on Quality Systems were published. These publications signified the internationalization of the approach towards quality.

Some of the important terms as defined in ISO 8402 are presented below :

Quality - The totality of features and characteristics of a product or service that bear on its ability to satisfy stated or implied needs.

Quality management - That aspect of the overall management function that determines and implements the quality policy.

Quality policy - The overall quality intentions and direction of an organization as regards quality, as formally expressed by top management.

Quality system - The organizational structure, responsibilities, procedures, processes and resources for implementing quality management.

The term, Total Quality Management (TQM), is not defined in ISO 8402. However, there are two sets of notes in the above ISO which say:

"1. The attainment of desired quality requires the commitment and participation of all members of the organization whereas the responsibility for quality management belongs to top management.

2. Quality management includes strategic planning, allocation of resources and other systematic activities for quality such as quality planning, operations and evaluations."

Some people take the above as to mean TQM, while others try to provide some other definitions. Joseph R. Jablonski has made such a remark : "Attempts to define TQM have led to many wandering conversations, meandering trails of misunderstanding and voluminous descriptions". At the same time, he also offered his own definition for TQM as :

"A cooperative form of doing business that relies on the talents and capabilities of both labor and management to continually improve quality and productivity using teams." (Jablonski 1990)

John S. Oakland has written that: "TQM is an approach to improving the effectiveness and flexibility of business as a whole. ... TQM is a method for ridding people's lives of wasted effort by involving everyone in the processes of improvement, improving the effectiveness of work, so that results are achieved in less time." (Oakland 1989)

It is therefore apparent that, by putting forth a definition consisting of a few words does not help to provide a thorough understanding of such evolving subject. There is a need to "walk through" some of the "foundations" on which the concept has been constructed. For such purpose the works of the quality gurus - W.E. Deming, W.A Shewhart, J.M. Juran, Philip B. Crosby, A.V. Feigenbaum and K. Ishikawa are reviewed as relevant to the TQM concepts.

Deming's Fourteen Points

Amongst the quality gurus, W. E. Deming is often cited as the very preeminent pioneer in this field. His work is said to lead to Japanese's successful mastering of the quality concept into world industrial leader. In recognition of his contribution to the economy of Japan, the Japanese Union of Science and Engineering instituted the annual Deming Prize, to be awarded for advancement of precision and dependability of product and service. He was awarded by the Emperor of Japan in 1960 the Second Order Medal of the Sacred Treasure (Deming 1982). A. Gabor, in her book : The Man Who Discovered Quality, gave a fairly detailed biography of Deming.

The root of the statistical quality concept of Deming can be traced back to his first full time job at Western Electric's Hawthorne plant in 1930's, exactly the where-about and when-about of the famous Hawthorne Experiment of Elton Mayo. It was also when Deming was introduced to his mentor, W. Shewhart, the Bell Laboratory guru who pioneered the use of the famous control chart as a quality technique (Gabor 1990).

Deming firmly believes that productivity increases with improvement of quality, and low quality means high cost and loss of competitive position, both production and service industries alike (Deming 1986).

On one hand, Deming's quality theory has a very strong statistical base, and his statistical control concept lays the foundation of many widely accepted quality control tools. On the other hand, Deming places strong emphases on management's quality role. Deming asserted that "constant quality improvement is management's responsibility, and most causes of low quality and productivity

belong to the system." The famous Fourteen Points of Deming concerning quality management are in his own words : "the responsibility of top management" (Deming 1986).

The following are the Fourteen Points of Deming, plus the essences derived from his elaboration :

1. Create constancy of purpose for improvement of product and service

Under this point, Deming raised two types of problems : today's and tomorrow's problems requiring top management's attention. Top management is required to :

(a) innovate

(b) put resources into research and education

(c) constantly improve product / service

(d) put resources into maintenance of plant and facilities

The above bring forth the concept of implanting constant improvement towards customer satisfaction into the vision / mission of the organization.

2. Adopt the new philosophy

By new philosophy, Deming refers to the non-acceptance of defective products, mistakes and untimely services as the norm of today's life. He warned against the high cost for tolerating such defects and mistakes.

3. Cease dependence on mass inspection

According to Deming, inspection is always too late, ineffective and costly. Deming advocates the need for process improvement, in lieu of mass inspection. However, Deming does not rule out totally the need for inspection, provided it is for quality, and the result of inspection must be fed-back to the system for analyzing and

improving quality.

4. End the practice of awarding business on price tag alone

Deming quoted Shewhart's saying that price had no meaning without a measure of the quality being purchased. He alerts buyers to look out for low prices. He also questions the policy of the U.S. government in awarding contract to the lowest bidders, without due attention being paid to the bidders' experience and capability of the directors.

He suggests some considerations on quality aspects to be in place in qualifying vendors. He also sees the necessity for mutual confidence and aid between purchaser and vendor in solving quality problems. To achieve such, he promotes a reduction in number of suppliers, and a single source for a long term relationship.

5. Constantly and forever improve the system of production and service

This means continual reduction of waste and continual improvement of quality in every activity, which according to Deming will bring about continual rise in productivity. Deming points out here that a lion's share of improvement in any process or activity must come from action by management.

6. Institute modern methods of training on the job

Deming cited a comment on the investigation report on a fatal accident at Washington Metro in 1982, which should not have put blame on the Metro operators, but rather the lack of correct training for these operators on the part of the Metro management. The "printed instructions" to be used for training should also be changed, according to Deming, to incorporate the right standard as to what can be accepted and what cannot, in terms of quality.

7. Institute modern methods of supervision

Here Deming introduces the concept of "empowerment" and involving shop-floor, i.e. people who are actually doing the job should be involved in the decision making on quality issues. Only through such openness, can management be informed of the needs for corrections. Again Deming maintains that this is the responsibility of management to enable it to happen.

8. Drive out fear

An example that Deming quoted was a survey on 13,000 randomly chosen U.S. workers in 1981. Among the 8,600 respondents, 45 percent said that they had personally observed or obtained direct evidence of wasteful activities, and 20 percent said that they did not say anything because to do so would be "too great a risk for me". This showed the fear of reprisal in disclosing wrongdoing.

Other kinds of fear, including the fear of management to ask question and take a position; the fear of employees to ask for further instructions, to report equipment out of order or other working conditions that impair quality; the fear to inquire into the acceptance criteria of jobs; the fear of not being able to meet production quotas by reporting or fixing defects. Deming suggests: "Fear will disappear as management improves, and as employees develop confidence in the management."

9. Break down barriers between staff areas

This is a very important concept that Deming has contributed to the TQM philosophies.

People in various functions may be doing superb in their own areas, and yet the company as a whole is still going down in terms of productivity. Deming attributes this to that each staff area is suboptimizing its own work, but not working as a team for the

company. The solution lies in that people in research, design, purchase of materials, sales, receipt of incoming materials, and people in the production, should learn the problem of each other and treating the other parties down in the chain as customer.

The concept of team-work and "internal customers" have become very basic and most often addressed TQM constituents.

10. Eliminate numerical goals for the work force

Deming negates the effect of slogans and posters, urging work-force to increase productivity. Instead, he values those media which explained to everyone that the management is doing constantly to improve the system, to make it possible to improve quality and productivity, not by working harder but by working smarter.

He does not object to setting one's own goals, but he considered that any numerical goals set for other people, without provision for a road map to reach the goal, have effects opposite to the effects sought.

11. Eliminate work standards and numerical quotas

Deming makes an explanation on the term "work standards" as to mean "measured day work". He views the work standards, rates, and piece work as "manifestations of inability to understand and provide appropriate supervision."

12. Remove barriers that hinder the hourly worker

By barriers, Deming refers to the system, or the lack of system which counter-acts the effort of the shop-floor employees to achieve what is required from him / her. Once again, Deming considers a management's job to remove such barriers.

13. Institute a vigorous program of education and training

New jobs or new skills are needed for implementing the new

quality practice, the new drive for productivity and the new system of work for achieving such. Therefore, there will be a need for more training to be instituted for preparing people to assume the new jobs and skills. Management staff will also need training for coping them with the new emphases and in the areas as revealed not adequate under the Fourteen Points.

14. Create a structure in top management that will push everyday on the 13 points above

To achieve transformation, companies must be committed to analyzing every project and every job with a view to constantly bettering it. Deming sees the need for management to obtain guidance from experienced consultants, but he further points out that consultant cannot take on obligations that only the management can carry out.

The Fourteen Points have received very high respect, as they do, in fact, crystallize the key quality management practices that have come to be accepted at most high-quality companies in the U.S. and Japan (Gabor 1990).

Shewhart (Deming) Cycle

Shewhart was a member of the Technical Staff of Bell Telephone Laboratories, Inc. - a research arm of the American Telephone and Telegraph Company (A. T. & T.). He was the mentor of Deming on statistical quality control.

Shewhart is regarded as the first to recognize that variability is a fact of industrial life and that it can be understood and managed using the principles of probability and statistics (Gabor 1990). Shewhart is best known for the "control

chart", whereby variation of a process is separated into two sources: chance causes (due to the system itself) and assignable causes (specific to the process and can be removed if discovered). A process is in statistical control when it is no longer afflicted with assignable causes (Shewhart 1939).

The Shewhart cycle is a four-step cyclical process, which has become a central theme of quality management in many leading American companies. It is more often referred to today as the "Deming cycle", because of the way it is popularized by Deming in Japan. Deming applies the idea to a customer-driven product / service design process, which continuously improves products and services in anticipation of the changing needs of the marketplace. In fact, the Japanese adopt the Shewhart (Deming) cycle as the principal model for establishing and carrying out quality management strategies throughout an entire organization (Gabor 1990).

The development of Shewhart (Deming) cycle can be traced back to Shewhart's proposition about statistical control operation in 1930's. Having proposed the existence of assignable causes of variability, Shewhart saw the need for going through a definite operation to attain a state of statistical control, i.e. the how for detecting and removing the assignable causes. He named three main steps in such operation : specification, production and inspection, which he drew similarity to the three steps in a scientific process of acquiring knowledge i.e. making a hypothesis, carrying out an experiment, and testing the hypothesis. He contented that the older concept of an exact science, these three steps would be independent, but they should not be the case in a dynamic environment.

In the statistical control operation, Shewhart maintains that

the three steps should be : "forming a spiral gradually approaching a circular path which would represent the idealized case where no evidence is found in step 3 to indicate a need for changing the specification, no matter how many times we repeat the three steps." (Shewhart 1939)

Deming expands on the above cyclical relationship of quality control, puts it in the perspective of identifying and anticipating the needs of customers, and introduces the famous four-step cycle : "plan, do, check, act". It has formed the basis of total quality control at leading Japanese companies, such as Toyota, Kansai Electric Power Company, and Fuji-Xerox (Gabor 1990).

Shewhart (Deming) cycle is also the basic model of continuous quality improvement in the TQM implementation process. The model can be used in tackling various quality problems and / or improvement opportunities. In general terms, the four steps consist of the following (Jablonski 1990):

Plan - Identifying improvement opportunity, defining problem, identifying the customer, understanding what quality characteristic is important, determine measurement method and yardsticks, all come under this step.

Do - Here improvement process / solution is developed and implemented.

Check - Following on the "Do" step to determine what actually happened, by measuring the quality characteristic and comparing them with the original or predetermined values.

Act - Here either the successful process is incorporated as standard, or the plan is reviewed or adjusted to capture the experience of the last operation, and the process repeats again.

Juran's Trilogy

J. M. Juran almost has the same fame as Deming in his contribution to the quality movement in Japan. Like Deming, he was invited by the Japanese Union of Scientists and Engineers to come to Japan in the 1950's, to conduct seminars for the Japanese managers (Ishikawa 1985).

K. Ishikawa in his book : "What is total quality control ? - the Japanese way" commented: "The Juran visit created an atmosphere in which quality control was to be regarded as a tool of management, thus creating an opening for the establishment of total quality control as we know it today."

Juran was a colleague of Shewhart and Deming in the Hawthorne Works in the 1920's. During that period, Hawthorne had a central inspection department, and Juran criticized that this approach made the quality decline. He also criticized that those companies in the U.S. which were practicing some quality techniques, were tool oriented rather than results oriented (Juran 1989). Juran very much advocated that management should have personal responsibility in quality.

Juran draws analogy of the quality function of upper management to the way they conduct financial function, and derives the famous Juran Trilogy: quality planning, quality control and quality improvement. These are the three managerial processes that the upper management should use in managing the quality function.

Under each of the three processes, Juran provides some elaboration about the major components, as follows :

QUALITY PLANNING:

Determine who the customers are

Determine the needs of the customers

Develop features that respond to customers' need

Develop processes to provide the features

Transfer the plans to operation

QUALITY CONTROL:

Evaluate actual performance

Compare to goal

Act on difference

QUALITY IMPROVEMENT:

Establish the infrastructure

Identify improvement projects

Establish project teams

Provide teams with resources, training and motivation

Juran represented the above by a the following diagram.

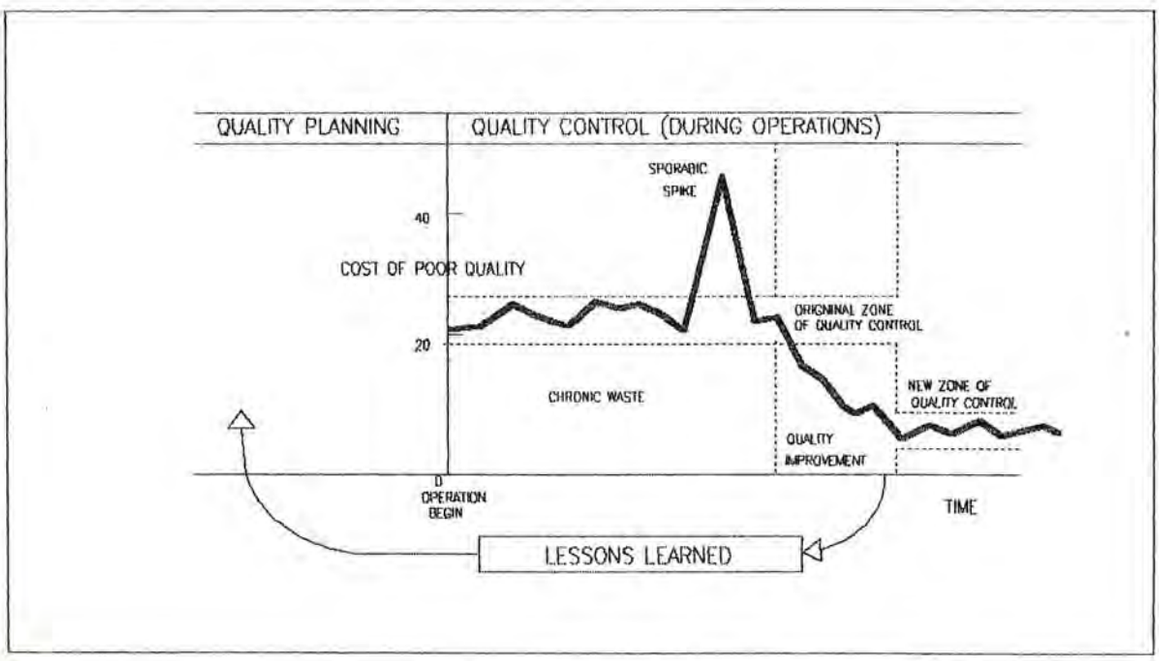

Fig. 3.1. Juran Trilogy Diagram

As far as quality planning is concerned, Juran put forth the TRIPOL model, whereby every unit in the organization and the organization itself assume the role of the "Processor" carrying out some activities. The other two roles, namely the "Customer" and the "Supplier" emerge, depending on whether the unit or the organization is receiving or providing output from or to the other "Processor".

Juran also suggests that tools like flow diagram and Pareto diagram can help to identify customers and prioritize important ones. Here, Juran elaborates on the important concept of "Internal Customer", and the stated needs and real needs of the customers.

Regarding the process of control, Juran emphasizes the importance of "self-control". He made such a remark : "To hold someone responsible in the absence of controllability creates the risk of unwarranted blame and of divisiveness."

Quality goals are prerequisites for control. Juran suggests the following criteria for quality goals :

- Legitimate, i.e. have official status
- Measurable
- Attainable
- Equitable

Quality improvement is the third process in Juran's Trilogy, but it is by no means the least important one. Rather than "fire fighting" which removes sporadic spikes to restore performance to prior chronic level, quality improvement will take the performance to an unprecedented level - closer to perfection (Juran 1989).

According to Juran, the quality improvement program needs to be "mobilized by the establishment of an infrastructure (quality

councils and project teams) with upper management initiatives. It has to be a structured and repetitive process, taking place on a project-by-project basis. The criteria for first project are such that it should be a "winner" - dealing with a chronic problem, and should be feasible, significant and measurable.

Crosby's Fourteen Steps

Philip B. Crosby is president of his own management consulting firm. Before that he was Vice-President and Director, Quality of the ITT (International Telephone and Telegraph Corporation) of the U.S.

Crosby is best known for putting forth the concepts of "Zero Defects" and "Doing things right the first time". Also, like Deming and Juran, Crosby is amongst the American quality gurus who blame American business problems on poor management, not poor workers (Crosby 1972).

Crosby has developed many models and methods concerning quality management, such as the Four Pillars (or the Four Legs, for the support of the "integrity systems" of quality), the Four Absolutes, the Quality Management Maturity Grid, the Make-Certain Program, and the Management Style Evaluation. Amongst these models and methods, the 14-step Quality Improvement Program is a comprehensive, practical and implementation oriented approach for quality management. The 14-step approach is also described by Crosby as "proven" (Crosby 1979). The following are the rudiments of the 14 Steps.

1. Step One: Management commitment

   Purpose : To make it clear where management stands on quality

   Crosby views quality policy an important manifestation of

management commitment. He goes further to comment that it is vital for each member of the operating management to understand and agree with the policy, and implement it.

2. Step Two: Quality improvement team

Purpose: To run the quality improvement program

Total quality concept is brought about by Crosby here, as he stresses that every portion (of the organization) must participate in the quality improvement effort. Therefore the quality improvement team should be formed by representatives of all the contributing departments. Crosby names the following main responsibilities of the team members:

- Layout the entire quality improvement program
- Represent their department on the team
- Represent the team to their department
- Cause the decisions of the team to be executed in their department
- Contribute creatively to the implementation of the improvement activity

3. Step Three: Quality measurement

Purpose: To provide a display of current and potential non-conformance problems in a manner that permits objective evaluation and corrective action

The importance of this step is made clear by Crosby in the above "purpose" statement, whereby measurement is serving as basis for the two most significant quality functions, namely evaluation and correction. Crosby also points out here that service measurement is more difficult than manufacturing measurement, but not impossible. He suggests that service measurement can be done upon the "software"

of the process. He introduces the term "paper-workmanship", and the basis of measurement being "the change caused by unplanned deviation from procedure".

4. Step Four: Cost of quality

Purpose: To define the ingredients of the cost of quality, and explain its use as a management tool

Several components for quality cost are exemplified by Crosby, namely scrap, rework, warranty, service, inspection, quality control and inspection. Crosby is not in favour of very involved techniques in calculating the quality cost, as the true value lies in calling attention to the problems and as means to identify those areas needing corrective action.

5. Step Five: Quality awareness

Purpose: To provide a method of raising the personal concern felt by all personnel in the company towards the conformance of the product or service and the quality reputation of the company

Crosby's idea of quality awareness is to make everyone (in the organization) aware of the need for improvement, and to prepare them for eventual commitment to the change program.

6. Step Six: Corrective action

Purpose: To provide a systematic method of resolving forever the problems that are identified through previous action steps

Here Crosby suggests the use of Pareto principle for operating (prioritizing) the corrective action, i.e. the biggest and most important problems should be attacked first, then the next biggest, and so on.

7. Step Seven: Zero defects planning

Purpose: To examine the various activities that must be conducted in preparation for formally launching the Zero Defects program

Crosby uses the term "Zero Defects" to denote the performance standard to be achieved by the organization. The quality improvement team will be responsible for studying and preparing the implementation of the improvement program.

8. Step Eight: Employee training

Purpose: To define the type of training that employees need in order to actively carry out their part of the quality improvement program

It should be noted here that when Crosby first put forth the 14 steps in his book : "Quality Is Free", the Step Eight is called "supervisor training", but in his later book : "Quality Without Tears", it was changed to call "employee training". The reason behind this, according to Crosby, was due to the advancement of the training media technology, which made it practicable for the training to reach all employees as it should be (Crosby 1989).

9. Step Nine: ZD day

Purpose: To create an event to let all employees realize, through a personal experience, that there has been a change

ZD ("Zero Defects") day is such that it helps enhancing the commitment of everyone, by signifying a mark for attitude (or cultural) change.

10. Step Ten: Goal setting

Purpose: To turn pledges and commitments into action by encouraging individuals to establish improvement goals for themselves

and their groups

Crosby sees the need for collaboration in terms of improvement goal setting. When goal is set by people who actually carry it out, better commitment will be assured and more satisfaction will result. But supervisors should be there to facilitate the process and not to let them settle for tasks that are too easy, too vague or too general.

11. Step Eleven: Error - cause removal

Purpose: To give the individual employee a method of communicating to management the situations that make it difficult for the employee to meet the pledge to improve

The accomplishment of this step, according to Crosby, is when people (employees) know that their problems can be heard and answered.

12. Step Twelve: Recognition

Purpose: To appreciate those who participate

Crosby considered that a proper recognition needs not be money award, and in any case the "prize" is not significant. Genuine recognition of performance is something people really appreciate.

13. Step Thirteen: Quality councils

Purpose: To bring together the professional quality people for planned communication on a regular basis

These councils so referred to by Crosby are sources of information on the status of programs and ideas for action. They should also determine any necessity for upgrading or improving the quality program being installed.

14. Step Fourteen: Do it over again

Purpose: To emphasize that the quality improvement program

never ends

The team members may change and the goals may be adjusted to cope with the new situation, or new goals can be set when the old ones are achieved. The main emphasis is that the quality improvement process is a continuous one.

Ishikawa and Feigenbaum on Total Quality Control

All of the above contribute significantly to the field of quality management, and are the foundation of TQM. However, two gurus who most explicitly put forth the total quality ideas are Ishikawa and Feigenbaum.

Feigenbaum was discovered by the Japanese, first in his role as the Head of Quality at General Electric, and then in translation of his books: "Quality Control: Principles, Practices and Administration" and "Total Quality Control" (Garvin 1988).

Feigenbaum introduces a system or total approach to quality. The basis of his approach requires the involvement of all functions in the quality process, and not simply production. In his own words : "Total quality control is an effective system for integrating the quality-development, quality-maintenance, and quality-improvement efforts of the various groups in an organization so as to enable marketing, engineering, production, and service at the most economical levels which allow for full customer satisfaction." (Feigenbaum 1983)

The scope of Feigenbaum's Total Quality Control (TQC) does not only extend to all the functional units of the organization, but also to all the stages of the industrial cycle. It starts with the identification of customer quality requirements and ends only when the product

has been placed in the hands of a customer who remains satisfied.

Feigenbaum is also famous for the concept of quality costs, which he categorizes into prevention costs, appraisal costs, internal failure costs (scrap, rework and spoilage), and external failure costs (customer complaints, warranty, purchase returns, court costs and liability penalties). He proposes the quality cost concept as means for measuring and optimizing TQC, and he proposes to use TQC to reduce cost (Feigenbaum 1983).

While Feigenbaum's works got translated into Japanese, the other advocate of TQC, Ishikawa of Japan, had one of his famous books : "What is Total Quality Control? The Japanese Way" translated into English and became one of the best sellers. In the book, Ishikawa denies that the Japanese imitate Feigenbaum's approach, and he comments that Feigenbaum still advocates the role of quality control specialists in TQC, while the Japanese way is to have all divisions and all employees become involved (Ishikawa 1985).

Nevertheless, Ishikawa's approach to TQC is in many areas quite similar to that of Feigenbaum, for example, his Company-wide Quality Control, and his cross-function management. His ten QC principles for vendee-vendor relations also exhibit similarity with Point 4 of Deming's Fourteen Points, concerning the joint effort of purchaser and vendor on quality problems. He also suggests elaboration on Shewhart (Deming) Cycle by sub-dividing further the "Plan" activity into: determine goals / targets and determine methods of reaching goals; and the "Do" activity into: engage in training and implement work (Ishikawa 1985).

Other contributions of Ishikawa include the cause / effect diagram (also known as fishbone or Ishikawa diagram), and the

Quality Control Circle (QCC).

TQM Examples

After reviewing some of the key foundation concepts about quality management, some further insights are sought by looking at some publicized TQM experience. For such purpose, the notes by some American utilities' executives about their TQM experiences are reviewed. These notes were published in the May, '92 issue of the Public Utilities Fortnightly, under the title of "1992 Electric Utility Executives' Forum: Total Quality Management."

The notes briefly outline the TQM experience of thirteen big public utilities, such as the Wisconsin Public Service Corp., Iowa-Illinois Gas & Electric Co., New York State Electric & Gas Co., Northeast Utilities. The following are found to be the key issues mostly addressed or emphasized on:

1. Corporate vision, mission and management commitment
2. Customer satisfaction
3. Cost reduction and productivity enhancement
4. Continuous improvement
5. Team-work and empowerment
6. Training

These key issues are now examined one by one, with additional reference to other literature, where appropriate.

1. Many of the TQM programs in these utility companies started off with a corporate vision / mission statement. To quote some of the wordings used by the utilities' chiefs:

- "... the "vision" will provide the guiding values to get all our functions and each and every one of the employees pulling in

the same direction." - by William B. Ellis, Chairman and CEO of Northeast Utilities.

- "If you do not already have a long-term vision, don't try TQM." - by Roger W. Hale, Chairman, President and CEO of LG&E Energy Corp.

- "First, our senior management developed a corporate vision corporate values, ..." - by John W. Rowe, President and CEO, New England Electric System.

These statements help to illustrate the significance attached to the role of corporate vision / mission in a TQM program. Developing a vision / mission statement by the management, as a starting point for the TQM program, signifies top management's commitment to the program. It also serves as a clear "road-sign" to all the members as to where the organization is heading through the TQM program. All the efforts can thus be lined up and built up to form a strong "total force" to move the organization in the desired direction.

The above is to some extent in line with a few of Deming's Fourteen Points e.g. create constancy of purpose (Point 1), drive out fear (Point 8), and create a structure in top management (Point 14); and also the Step One : Management commitment of Crosby's Fourteen Steps.

Having a vision / mission statement formulated is though a apparent step to commit management, yet it is not the end of it. In the landmark Ernst & Young / American Quality Foundation International Quality Study, which examines quality practices in Canada, Germany, Japan and the U.S., it is revealed that management commitment is a serious problem, especially in the U.S. There is obviously a big gap between what senior managers say is

important, and what they actually heed (Bowles 1992).

Another study by UMIST (Manchester, UK) on some European companies practicing TQM, also highlighted the problem of management commitment. As a result, there is a lack of management credibility and very low level of adoption of the quality practice (Dale & Lightburn 1992). As pointed out by Larry Axline - the Managing Director of Management Action Planning, Colorado : "When committed leadership is lacking, the various pieces of TQM do not fit together in a coherent pattern." (Axline 1991)

2. 'Customer satisfaction' is addressed for most of the time in the notes on the utilities' TQM programs. Some utilities treat it as their target / goal, while some capture it in their strategic plan. Several measures of customer satisfaction are cited by the utility chiefs, which include rates, reliability, responsiveness, errors and safety.

The importance of customer satisfaction as a quality issue can be recapitulated from some of the quality guru's works. Customer need is incorporated as the first function in Juran's Trilogy model. Feigenbaum has put total customer satisfaction as a key to his total quality control concept.

Under the famous Malcolm Baldrige Award scheme (the US equivalent of the Deming Prize), "Customer Focus and Satisfaction" is one of the seven categories of criteria, accounting for 30% of the points (Brown 1991).

The idea of customer satisfaction embraces both external customers and internal customers. Many quality management writers have written about internal customers, including Deming and Juran. In fact, the Malcolm Baldrige Award criteria also include an item

called "Internal Customer Satisfaction". Chris Lee - the Managing Editor of Training Magazine has written: "Regardless of your job, you are a link in a chain of internal customers and suppliers that leads, eventually, to your company's external customer". In answering: "Who is the internal customer?" Lee cited the question for an answer: "Into whose in-basket do I empty my out-basket?" (Lee 1991)

3. Cost reduction and productivity enhancement are very frequently mentioned as the targets for the TQM programs for the utilities.

TQM as a means of reducing cost and enhancing productivity is related to the quality cost concepts of Feigenbaum and Crosby. As Feigenbaum has said that satisfactory quality means satisfactory resource utilization and consequently lower costs (Feigenbaum 1983). Another remark very relevant to this issue is one made by Crosby in the very beginning of his book "Quality is Free": - "Quality is not only free, it is an honest-to-everything profit maker. Every penny you don't spend on doing things wrong, over, or instead, becomes half a penny right on the bottom line."

It has been estimated that the quality related cost of the non-productive activities, i.e. wastes, is as high as 20% of the sales revenues across a wide range of industries (Porter and Rayner 1992). William Conway has written: "The waste exists in four main forms: waste of materials, waste of capital, waste of time, and waste owing to lost sales or opportunities", and he suggests the elimination of these wastes is through continuous process improvement under TQM (Conway 1992).

Some TQM approaches actually take costs / wastes reduction as initial improvement projects, for bringing in a sense of "early

success" to enhance confidence of staff and management. One of the recommended solutions for implementing TQM in Canadian health care industries was that, initial improvement projects should generate hard-dollar improvements, either increase in throughput or a reduction in scrap, waste, or critical time (Gopalakrishnan 1992).

4. Continuous improvement is apparently a main theme in the TQM practices in many of the TQM examples. It appears in a variety forms of descriptions used by the utility chiefs, e.g.:

- "to continually improve those processes that increase customer satisfaction" - by the President and CEO of Wisconsin Public Service Corp.
- "development of systems to measure performance and continue the improvements" - by the Chairman, President and CEO of New York State Electric & Gas Corp.
- "Plan for Excellence program emphasizes continuous improvement....." - by the Chairman and President of UtiliCorp United.

The Shewhart (Deming) Cycle as mentioned earlier manifests very well the continuous improvement concept in TQM implementation. Also the last of Crosby's Fourteen Steps - "Do it over again", helps to support that quality improvement should be everlasting.

The continuous improvement theme is very relevant to today's ever-changing business environment. Competition and customer expectation are growing in parallel, and technology is evolving at a high rate. Quality demand cannot be a static one. Roy Conner has described their quality effort at Florida Power and Light (the non-Japanese winner of the Deming Prize) : "Our current team looked for ways to fine-tune the process, ... and is still asking the fundamental question - how can we best serve our customers?" (Conner 1992)

5. Team-work and empowerment are the most important human elements in TQM programs, as reflected in the experience of the utilities. The two elements are very often going in parallel. The reason is obvious, as the effectiveness of a working team very much depends on the autonomy (authority and power to make decision) it has.

Shuster (a famous quality writer and consultant) has associated teaming with "human empowerment through intellectual liberation". He goes on to say : "Individuals, working together, within formal procedures, encouraging an environment of free expression, innovation, and consensus, to decide an issue, solve a problem, or improve a condition." (Shuster 1990)

A very well-known form of team-work effort towards quality is the Quality Control Circles (QCC) originated from Japan. They are frequently cited as the key to Japan's superior quality. However, QCC is criticized to be limited in value than the team-work in the TQM sense, where the latter is concerned with teams cutting across functions (Hill 1991).

Team-work more in line with the systemic principle of TQM is the Company-wide Quality Control (CWQC) team introduced by Ishikawa and the TQC team introduced by Feigenbaum (Garvin 1988). They are very similar in concept to the Project Team as used by Juran. Juran has contrasted his Project Team concept with that of the QCC, whereby scope and membership of the former is "multi-departmental" (Juran 1989). Teams of a multi-departmental or cross-functional nature help to eliminate barriers between functions and facilitate the acceptance of the recommendations by the respective functions.

CWQC teams, Project Teams, Quality Improvement Teams or whatever name they are given, are not only there to formulate and recommend changes, but they are also used for implementing the changes. Glen has cited some examples of the achievements of such team-work: a team at Florida Power and Light saved the company $450,000 a year by eliminating billing delays; and a team at Xerox saved the corporation $4.4 million by streamlining construction and distribution of price lists (Glen 1991).

6. Training has received a lot of emphasis in the TQM programs of the utilities. In fact, some of these utilities have indicated that the training element has taken a majority of the time and effort, and the training is for many aspects, such as building up quality awareness of the whole organization, developing the management culture and leadership to facilitate the change, educating team members on the use of various quality tools, and so forth.

The significance of training is incorporated in Point 6 of Deming's Fourteen Points, and in Step 5 and Step 8 of Crosby's Fourteen Steps, as well as in Juran's Trilogy as mentioned above. Ishikawa also made note of the importance of training as he commented on the failure of the Zero Defect movement in the U.S. in the sixties. He described it as a movement without tools, as it failed to teach the participants the method of implementation (Ishikawa 1985).

A study by the Quality Alert Institute revealed that many US companies made a major investment in quality training. A suggestion based on the findings of the study is that, for a company to derive the benefit of TQM, everyone must be trained, but training objectives should match with the level of duty in the TQM organization (Zagarow

1990). It is also suggested that continuous training for the implementing level serves the following purposes :

- Fosters an attitude of change among employees
- Makes them view from customer's perspective
- Demonstrates management's commitment
- Transmits and instills knowledge
- Provides quality tools
- Encourages day-to-day application of knowledge
- Helps to build corporate culture
- Builds up team spirit and team problem solving skills

To summarize, in the TQM examples based on electrical utilities in the U.S., some key issues are identified, which are relevant to most TQM program implementation, and are very much in line with the principles put forth by most of the quality management gurus. It is also noted that different organizations, and different parts of an organization, can have different emphases, in conducting their TQM practices. A relevant remark is that a contingency view should be developed which links the appropriateness of solutions to their context (Chorn 1991).

CHAPTER IV

STUDY FINDINGS

The study is on a project management department of CLP, and the associated TQM team process. But before focus is made on the department and the team, it would be appropriate to look at the TQM program as it is applied to CLP as a whole.

TQM Program of CLP as a Whole

On July 22,1991, the Managing Director of CLP announced the vision and mission statements of the company (Appendices 3 and 4), which signified the starting point of the formal TQM program.

Before then there has been some small scale quality-related change and education programs taking place within the various departments in CLP. For example, the head of the Distribution Department made a comment in an interview with the Hong Kong Productivity Council in November, 1991: "the issue of quality has for several years been a company concern and been practiced at the district and regional workshop level, the recent TQM exercise demonstrated commitment from the top."

The top management commitment is further demonstrated by the appointment in October, 1991, of a new managerial position - the Corporate Development Manager, which has full-time responsibility of overseeing and coordinating the launching of the TQM program. Secondments from other departments were later injected into the team, and external specialists were also drawn from an U.S. TQM

consultant. A series of TQM training were conducted, with the help of the U.S. consultant, covering the senior management, middle management and supervisors.

TQM Organization and Major Activities

As mentioned above, the company-wide TQM program is being guided and supported by a specialist team (referred to as the TQM Specialist Team here-after) under the leadership of the Corporate Development Manager, with members consisting of secondments from other departments and external consultants. Some ideas about the basic organization and activity planning is gathered, through the interviews with the members of the TQM Specialist Team, and based on the publications of the Company (e.g. in the in-house newsletter of CLP).

Basically, the TQM activities will be extended to every department, and Total Quality Awareness training will be provided to every employee eventually, including the industrial staff[1]. The TQM Specialist Team will oversee the training program, with help from the external consultant, as necessary. It is anticipated that, to cover the whole work-force of more than 6,000 people, the Total Quality Awareness training will have to run for more than two years, and some of it will need to be conducted in Chinese for those industrial staff who are not conversant with English. A "train-the-trainers" approach will be adopted, whereby more senior staff will be trained to take up a trainer role, for conducting the Total Quality Awareness training for the lower level staff.

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[1]"Industrial staff" is the classification used by CLP to cover those houly-paid employees, which amount to about 3,000 most of which are manual workers.

The basic TQM organization to solicit participation takes the form of Improvement Teams. They are formed by members across departmental boundaries, to study how work can be improved, e.g. how time, materials and money are best utilized for satisfying the need of the customers, both internal and external. To do this, they are trained in various quality tools and techniques, to help them on their study of the process itself, and to promote effective communication and cooperation within the team.

The Improvement Teams are working under the guidance of Quality Councils. The Quality Councils regularly review team progress and are responsible for providing TQM training, communication and recognition. They also review and authorize the improvement measures recommended by the teams. Membership of the Quality Councils is drawn from Branch, Departmental and Divisional management.

In turns, the Quality Councils operate under the guidance of the Senior Quality Council. The Managing Director and Divisional Managers are the members of this Council which determines the overall direction objectives and priorities for the Company. Linkage between the Councils is achieved as members of the Senior Quality Council also participate in appropriate Quality Councils.

In early 1992, a Pilot Improvement Team was formed and was chartered with a task to improve on transmission project process and to reduce the project cost, which is the subject of this study.

Total Quality Awareness Training

All CLP employees will be subject to a Total Quality Awareness training on a "batch" basis, starting from the senior staff. The heads

of the Departments, who had been nominated the members of the Quality Councils, were given a more in-depth session lasting for three days. The other employees are given a two-day sessions.

The structure of these training sessions are very similar. The participants are from different departments but of similar rank and related functions. The consideration, according to one of the session tutors, is to facilitate exchanging of viewpoint and sharing of ideas, especially when it comes to simulating or making reference to real working situation. This is aimed to cultivate the "internal suppliers / customers" concept.

The first few sessions were conducted by external consultants based on the training material generated by them tailored to CLP situation. The course is divided into seven parts:

1. Introduction
2. Leading Total Quality
3. Planning Total Quality
4. Measuring Total Quality
5. Improving Processes
6. Improving Services
7. Involving Employees

As apparent from the course manual, the course is built upon a model very similar to Juran's Trilogy i.e. Quality Planning , Quality Control and Quality Improvement. Adding onto it are the elements about leadership and employee involvement.

In the introductory part, a definition for TQM is cited by breaking down into its attributes as follows :

T :"At every level, in every department, with every process...."

Q :"making continuous improvement to meet or exceed customer

expectations ..."

M: "by establishing the systems and culture to achieve Total Quality results."

Therefore a lot of similarities with the total quality concept of Feigenbaum and Ishikawa are apparent here. And concerning the element on continuous improvement, the approach advocated by the course is the Plan-Do-Check-Act cycle and the "constancy of purpose" concept by Deming. At the closing of the introductory part of the course, a comparison is drawn on the traditional way of thinking and the practical way it should be, very similar to the Four Absolutes of Crosby :

- Quality is defined as conformance to requirements, not goodness

- Quality is measured by the price of nonconformance, not indexes

- The quality performance standard is zero defect, not acceptable quality levels

- The system to achieve quality is one of prevention, not appraisal

The other parts of the course are very briefly mentioned below.

The part on leadership highlighted the importance of commitment, communication and other leading skills e.g. envisioning, proposing structure, monitoring structure, listening for understanding, harmonizing for consensus, giving feedback and empowering people. It also covers the significance of vision and mission, and the importance for them to be shared with the other members of the organization.

The third part of the course is on planning. The steps covered in this part include specifying customers, clarifying customer requirements, interpreting requirements, prioritizing requirements, bench-marking competitors, prioritizing improvement opportunities, specifying company resources, identifying resource conflicts, relating customer requirements to company resources, and stating improvement goals. It also covers some planning tools, such as brain-storming, relation diagram (organization map), systemic diagram (process map), and matrix diagram (very similar to Juran's spreadsheet as used in Quality Planning).

The fourth part is on measuring, and it covers such steps as determining measures criteria, selecting team and developing measures, approving measures, creating measuring plan and communicating the measures.

The fifth part of the course is on improving processes, and it covers the process analyzing tools such as Pareto chart, flow chart, histogram, cause-effect chart, scatter chart and control charts, for identifying process capability and improvement goals.

Under the sixth part on improving services, the technique of soliciting, treating and responding to customer comments and feedbacks are covered.

The last part of the course is on employee involvement. It covers such topics as team efforts, training employees, empowering employees and recognizing employee contribution.

The basic purpose of the course is to provide a general understanding of the total quality philosophies, strategies and methodologies, with particular reference to a service environment. Continuous improvement, customer satisfaction and team-work are

receiving much emphasis. Workshop like sessions are also included for practicing some of improvement tools on a team basis. According to a member of the TQM Specialist Team, it was hoped that through the training, credibility would be created as regarding the significance and usefulness of these TQM concepts and principles.

Up to the end of 1992, about one-fifth of CLP's employees have undergone the Total Quality Awareness training. The remaining will be trained by trainers developed in-house, through the train-the-trainers scheme.

The general comment from the participants on the training was very favourable, saying most of the materials were practical, useful, and appealing, but some said that the training schedule was too tight.

Besides the above Total Quality Awareness training, there were other training packages being run by the TQM Specialist Team. Some of these packages were tailored for the improvement team facilitators and the team leaders, while some of them were tailored for the improvement team members. Transmission Projects Department, the subject department of this study, was amongst the first few which had most of their staff nominated to the above training.

Transmission Projects Department

There are altogether fifteen departments in CLP under four Divisions, namely the Engineering Division, Operations Division, Planning and System Division, and Finance and Administration Division. Transmission Projects Department (TPD) is one of the four departments belonging to the Engineering Division of CLP.

TPD is responsible for implementing capital development

projects in the CLP transmission system to meet the growing electricity demand. The transmission system comprises substations, underground cables and overhead transmission lines, ranging from 400 kV to 11 kV.

The organization of TPD is further divided into four Branches, each specialized in different functions, as shown in Appendix 5.

In basic terms, TPD is providing the necessary in-house engineering resources, for the execution of the transmission system plan, to convert it into physical assets in the form of substation equipment, cables and overhead transmission lines. In carrying out such role and to cope with CLP's system expansion, TPD at any one time manages under its four Branches, approximately 180 projects, with an annual expenditure of around HK$ 2 billion.

The major project management / engineering activities in TPD include :

- Feasibility studies of projects, both technical and financial
- Project budget preparation, monitoring and control
- Project program preparation, monitoring and control
- Technical specification of equipment and project scheme
- Prequalification of equipment vendors
- Tendering and contract management for equipment procurement
- Technical approval and progress monitoring of equipment supply
- Erection the equipment on site and commissioning
- Liaison with various government authorities on various project aspects, e.g. substation site acquisition, circuit wayleave acquisition, environment issues, license and permit applications, etc.

- Liaison with major developers whenever the project plans are related to the major development items

- Liaison with various internal departments to coordinate various inputs for project implementation and handing over

In managing the above activities, TPD is concerned with many basic factors, for examples, the cost, time and human factors. Understanding these factors will help the later analysis of the TQM effort, its focus and constraints.

The cost factor has been receiving great emphasis, as both a means of control and a measure of performance. The importance attached to the cost factor is reflected in the opening remark of a TPD promotion bulletin: "TPD maintains self-sufficient technical and management expertise which, together with a strong emphasis on cost-effectiveness, is a primary factor in its approach."

The following chart shows the growth of transmission project costs in the last ten years.

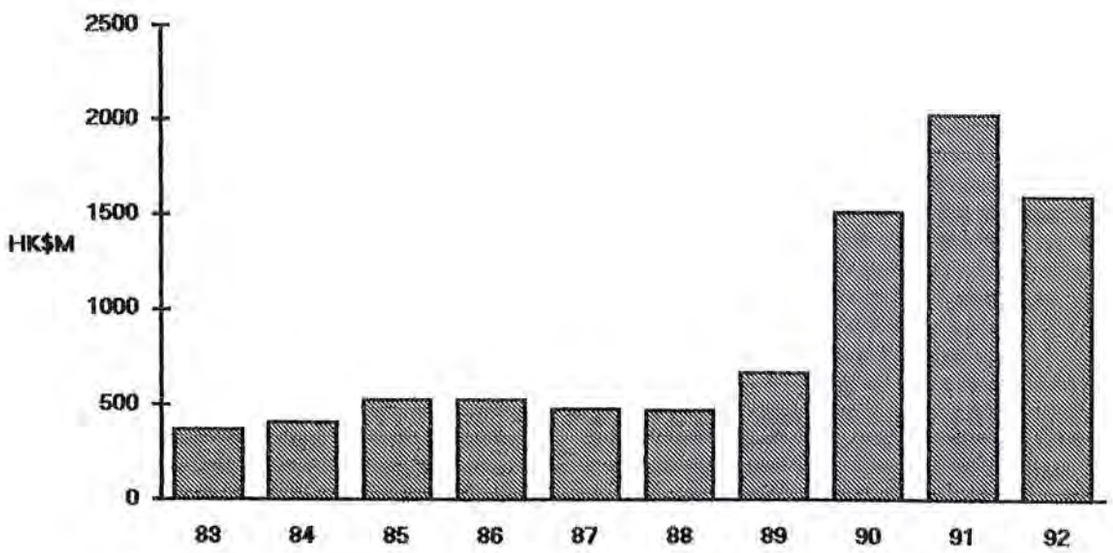

Fig. 4.1. Transmission Projects Costs of CLP from 1983 to 1992

The growth is partly due to the expansion of the system demand, and partly due to the inflation in prices of the constituents. The main components of project costs are typified below for one main kind of projects being handled by TPD - the substation[2] projects.

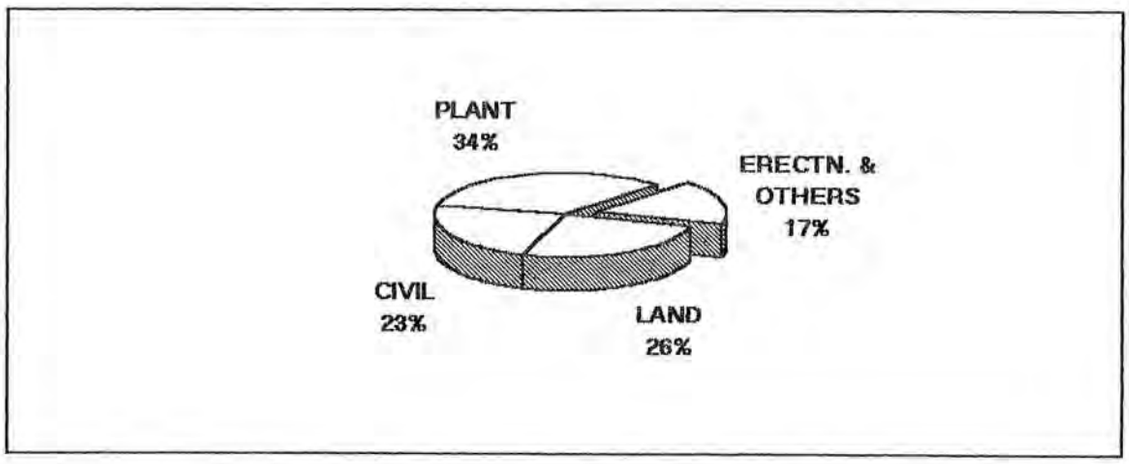

Fig.4.2. Composition of Substation Project Costs of CLP

TPD monitors and controls these cost constituents through an established budget system, such that the actual commitments and expenditures are compared with the approved figures on a regular basis. Any major variances have to be substantiated and ratified at the appropriate authorization levels.

Amongst the various cost components, the plant / equipment cost constitutes the largest proportion of the total project cost. One of the main source of variance in this kind of cost is due to the change of suppliers. In recent years, TPD has adopted what is known as a "bulk purchase contract" approach of procurement. Rather than

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[2]A substation is a premise where electrical power equipment, such as high-voltage switches, power transformers, control, protection and supervisory equipment are accommodated, for controlling and transforming the power transmission and distribution circuits of a power system.

tendering for every single piece of equipment for every project, the same or similar kind of equipment is tendered in bulk, based on an estimated quantity requirement over a long period, usually five years. The successful tenderer will be awarded a long term contract, which enables CLP to order, from time to time any quantity of the equipment as required by means of "call-off orders". This approach does not only simplify the procurement processes, but most important of all, it makes the equipment price more predictable and brings along other technical advantages, such as more familiarity with the products and services, better supplier relationship, less spare parts, etc.

Land and civil costs form the second and the third largest project cost components. Besides, they impose the highest risk, in terms of budget control. They fluctuate over a wide range, depending on the site condition, method of development and market trend. Land cost, in particular, will also vary according to the location, the development potential, and the change of town plan and policy of the government. In one or two projects, the land costs are even higher than the total equipment cost of the substation.

The Department Head of TPD has expressed at a utility management seminar: "The power utility business is perhaps the most complex of any industry. Its successful performance may be measured by various parameters.... In the business context, however, the monetary aspects are likely to be the main driving factor influencing the philosophy of approach." This further illustrates the concern of TPD over project cost, and the means of putting it under control.

The time factor is another important performance indicator for TPD. TPD monitors the time factor through what is known as the

Master Project Program (MPP), which is basically a "Gant chart" for each project broken down into its component activities. The main information appears on the MPP includes the name of the activities and the associated timing requirements, the responsible parties, the critical paths and the various key dates. One example of such MPP is shown in Appendix 6.

TPD has computerized the MPP through some project management software. The present level of computerization enables some standard project progress monitoring, reporting, work-load forecasting and resources coordination to be carried out. There is a plan for the computerization to be enhanced to provide more sophisticated project management capability. For example, one idea will be for the project budget and project program to be linked, so that the interaction between the two can be more easily determined for better decision making.

Time and money are important project ingredients, but it is the human effort which makes these ingredients work to produce the desired results. TPD management has been very explicit about their policy to maintain self-sufficient technical and management expertise, to support all the phases of the multi-project work. Such a policy entails a well trained and highly motivated work-force. TPD management has made available many training and retraining opportunities for its staff members. In fact, before the TQM program was in place, TPD had subjected its engineering staff to some of the quality training, such as the ISO9000 training. Many job related training, for examples the safety training, work-skill training, supervisory training, and managerial training are actively pursued by TPD staff with general support from TPD management.

Besides the time, cost and human factors as mentioned above, the following are some other factors which are considered by many TPD members as important to project success:

1. Users' requirement

The "users" of projects are those departments within CLP, to whom TPD hands over the project asset upon completion. The main users include the Transmission, Distribution and System Operations Departments. It is imperative that the requirements of the users are incorporated throughout the project execution, to ensure a satisfactory taking over of the project. Many of the users' requirements have been incorporated into documented standards, manuals, codes of practices, etc. It is important for TPD engineers to be conversant with these documents and act in compliance with them. However, there are also requirements which have to be solicited, reviewed, clarified and agreed upon, throughout the project process, through close liaison with the user departments. Communication and cooperation across department boundaries are therefore very important in this regard.

2. Contractor performance

Through the execution of projects, TPD introduces into the CLP system the services and products of external contractors. TPD is therefore accountable for the performance of these contractors. The quality of the output of these contractors, should it be an engineering feasibility report, or a power transformer, would be directly reflected into the overall project quality which TPD is responsible for. The means which TPD is using to ensure that the contractors do perform are various, starting from the stringent prequalification of tenderers, through structured process of design

approval. Independent consultants are sometimes employed to inspect and witness tests on finished or semi-finished products in the contractor's premises, to ensure compliance with CLP requirements.

3. Safety

CLP as a whole has been giving great emphasis on safety in every part of its operation. The General Manager has sent a note on safety to all Department Heads, which said: "...CLP had an objective to achieve a standard of safety equivalent to that being achieved by major international corporations". To achieve such an objective, CLP management introduced in 1990 a "5-star Health and Safety Management System" for all departments to follow. For TPD, safety is a fundamental requirement for every project, not only because TPD has direct responsibility on the safety of its employees or contractors, but also due to the fact that many of TPD's project activities are in contact with the public. Examples include the road excavation for laying the power transmission circuits, the demolishing of existing substation for redevelopment, the transportation of heavy power equipment to site, etc. Therefore, TPD's safety obligation is not only limited to its employees or its contractors, but extended to the public at large. A safety implementation policy has been announced by TPD in April 1991, which reads: "The Department realizes the fact that our fundamental department mission is to construct and make provisions for power transmission at the highest attainable quality in a safe and cost effective manner." This demonstrates TPD's commitment to safety.

4. Environmental factor

TPD's concern for environment is illustrated by the following paragraph, extracted from a whole chapter devoted to "Environmental

Protection" in the TPD's brochure: "TPD places great emphasis on environmental protection, ensuring that at all times, measures to minimize disturbance to the surroundings are incorporated into its engineering projects."

It is inevitable that project construction work will cause disturbances of some kinds to the environment. The policy of CLP is that such disturbances should be kept to a minimum. Following through such policy, TPD has incorporated various kinds of environmental protection measures during project implementation. Examples are that the landscape affected by overhead-line pylon is restored by planting trees and shrubs on the finished soil; colour scheme and orientation of substation buildings are such as to blend with the surroundings; noisy equipment, such as the transformers are located remote from the nearby residents or shielded by acoustic barriers, and so on.

All the above factors are in essence indicators of TPD's project performance, although some are not so readily quantifiable. In order to achieve high quality projects, a good balance of these factors are necessary, depending on the specialty of the projects and the prevailing corporate strategies. The rise in the concern for the cost factor has become apparent, as the Company as a whole is trying to conserve capital, preparing for the new power station funding. The concern has actually been manifested to become the subject task of a Pilot Improvement Team, established under the TQM program.

Pilot Improvement Team

A Pilot Improvement Team[3] was formed under the custodianship of Transmission Project Department in March, 1992. It consists of six members, each from TPD, Planning Department, Civil Engineering Department, Technical Services Department, Transmission Department and System Operations Department. These departments are all functionally related in the process of the execution of any transmission projects, as shown in the project process map to be discussed later, and as mentioned above, some of them are direct "users" of TPD projects.

The Improvement Team reports to a Quality Council formed by the Department Heads of the above mentioned departments. The "Team Charter" is shown in Appendix 7, which spells out the responsibility of the Team as "documenting and analyzing the current transmission design and engineering process from planning to execution, generating a prioritized list of improvement opportunities, and implementing changes identified as high priority items in order to reduce project costs by 20%". Constraints are also given such that all recommendations made by the team must not compromise safety standards or change the transmission plan, and they must be within statutory requirements.

Team Training

All the team members of the Improvement Team have gone through the Total Quality Awareness training as mentioned above. In fact, they were amongst the nominations for the first few batches of

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[3]The Pilot Improvement Team was given the name of "Transmission Projects Team" by the team members, but for the sake of this study, it will be called the Improvement Team or the Team for simplicity.

the awareness training. They were then subjected to a more in-depth training, which included the training on the meeting techniques and some of the TQM tools.

Based on the review of the training manual and discussion with some of the Improvement Team members, the coverage of the subsequent in-depth training is briefly described as follows.

The first part of the in-depth training was on meeting skill, as the Team had to confer a lot, to work through their task. The two basic meeting skills which they were trained were about the way to structure meeting and the listening skill that they should use during meeting. In the part concerning structure of meeting, the skill emphasizes on stating and agreeing on the purpose, the process and the product of the meeting. In the part concerning listening skill, the guiding principles are attending, confirming / clarifying, and reflecting feeling.

Concerning the TQM tools, the Team was trained on the following :

1. Organization Map

Diagram to show how work is accomplished in multi-disciplined organization, to help to analyze job structure, to identify "Disconnection", "Bottleneck" and "No input from customer"

2. Process Map

Diagram to show the interaction of the various functions in a process, to help to identify improvement opportunities on Quality, Cost and Time.

3. Affinity Chart

A structured way of displaying and grouping ideas generated in brainstorming sessions.

4. Pareto Chart

A famous TQM tool based on the Pareto principle (or the 80/20 rule), to visually present the categorized data, for prioritizing improvement opportunities.

5. Run Chart

Similar to the control chart, for displaying variation of a process from the average, over time.

6. Frequency Chart

Also known as histogram, a visual presentation of the frequency distribution of the measured data, to reveal the variations.

7. Scatter Chart

Plot of two variables to show the impact of one on the other.

8. Fishbone Diagram

Also known as the Ishikawa Diagram, owing to its inventor, which maps out all the causes for certain outcome (effect), for further analysis.

The training of the meeting skills was conducted in the form of workshop, such that the members were given chance to practise the techniques through some simulations of real meeting situations. As regarding the other tools, exercises were contained in the training manual, and some of them were worked through in the team sessions on a selected basis.

According to some of the Team members, though some of the tools and skills sounded familiar to them even before the training, yet they appealed to them in a more meaningful way in the above course setting, where they were learnt and practised in a team environment, for a common purpose. In many occasions during the course, they often thought through or tried out some of the above

tools on subject matters related to their Team Charter, and they concluded that the Organization Map, Process Map, Affinity Chart, Pareto Chart, and Fishbone Diagram would be particularly relevant to their process.

Team Process

Under the TQM organization, the Improvement Team reports to the Quality Council, which in turn reports to the Senior Quality Council, on all relevant issues and progress of the team process. Both the Improvement Team and the Quality Council are basically cross-functional teams, as they consist of representatives from almost all the concerned departments, which are directly involved in the execution of the projects.

Some of the members of the Quality Council are serving more than one Councils, and so they are what is known as the "linking-pins" of these TQM units, such that experience can be shared, effort can be coordinated and communication can be enhanced.

The Team Leader of the Improvement Team was appointed by the Quality Council. According to the team members and the appointed leader himself, the role of the Team Leader was perceived to be one for helping the team to achieve its objective while building a cohesive group. The Team Leader ensured that the team meetings were effective, and that the administration details, e.g. the agenda, the minutes and the timing of the meetings were well attended to. The Team Leader also served the "linking-pin" function as mentioned above, by part-taking in some of the Quality Council meetings.

The Team had met for more than 15 times since established. The first few meetings were attended also by the "facilitators". The

facilitators either came from the consultant company, or from the TQM Specialist Team as mentioned above. The roles of these facilitators were to conduct training to the team members on the TQM methodology and tools, to give advice as necessary regarding the team process and to provide feedback to the team as an observer, on areas where improvements could be made.

The first few meetings (about three, as recapitulated by the team members) were kind of running-in sessions, whereby the training workshops on some of the tools and meeting skills took place, and also the "values / ground rules" (Appendix 8) were set up.

A time schedule was worked out by the Team as shown in Appendix 9. As indicated in the time schedule, the Team process was roughly divided into four stages, covering a period of about 20 weeks. The first stage was concerned with the study on the current process. The second stage comprised identifying the improvement opportunities, analyzing these opportunities, and determining the changes. At the third stage, action plan for implementing the changes was developed. The fourth stage was to implement the plan and monitor the progress. The completion of each stage was marked by a presentation by the Team to the Quality Council.

As agreed amongst the members, their attention would be centred upon the substation projects process. The first exercise of the Team was to analyze the project process, from project inception to completion. The tool that they used was the Process Map. They firstly determined the functions involved in the process, and then they identified the process step and the process decision. The process was then mapped out to link up all these elements. Reviews,

corrections and refinements were then carried out in the subsequent meeting, and the final Process Map was produced as shown in Appendix 10.

The key parties as identified by the Team to be concerned with the project process included the government, the vendors (equipment suppliers), Planning Department, System Operations Department, Transmission and Distribution Department, Transmission Projects Department, Secretarial Department, Civil Engineering Department, Scientific & Technical Services Department. Project inception is signified by the "Project Definition" produced by the Planning Department. It is then manifested into various activities to be implemented by the Transmission Project Department, going through design/engineering, procurement, site-construction, until it is handed over to the Transmission and Distribution Department.

The six members in the Team were from the six of the key functions involved in the transmission project process. Their inputs were therefore regarded as most relevant in terms of improving on the project process itself and the productivity of the constituent factors. Amongst all the constituent factors, project cost was the one that the Team concentrated most of their effort on, as it was the target issue addressed in the Team Charter.

Brainstorming session was held in the Team meeting to identify the relevant project cost elements for typical transmission substation projects. Affinity chart was used in the session to make it a systematic process. After the session, several team members were then assigned the task of collecting data related to the measurement of each of the identified cost elements. Pareto analysis of these cost elements was carried out in the subsequent meeting. The results are

showed in Appendix 11.

Based on the Pareto analysis, the three major classes of cost elements contributing significantly to the project cost are land cost, civil cost and equipment cost. In total figure, the equipment cost represented the biggest trunk amongst the three costs. This cost trunk was further analyzed into its components, i.e. in terms of the individual type of the major equipment, to facilitate the investigation process. A "Fishbone Diagram" analysis (Appendix 12) was carried out by the Team to identify the major attributes of these major cost elements.

Another brainstorming session was held by the Team to identify the possible cost reduction areas for the above cost elements. Appendix 13 contains the results.

Each of these areas were reviewed and studied, with further data being collected and discussed amongst the members. A list of cost reduction opportunities were formulated. In order to prioritized these opportunities, the Team used a set of four criteria, namely cost, time, control by CLP, and ease. The cost reduction opportunities were prioritized according to their contributions to the criteria. An extract of the prioritized list is shown on Appendix 14.

The top eight items, which were regarded as contributing significantly to the criteria, were then selected for further study. For example, the first item regarding substation layout was studied in detail, as regarding how it could contribute to reducing the site area requirement and substation building dimensions. On this basis, the Team proceeded to collect and analyze the relevant information, which included the typical / standard substation layout and dimensions, the design criteria and codes of practices, relevant

government regulations and requirements, the established operation and maintenance provisions and space requirements, the recommendations from the equipment suppliers, etc. All these details were tabled for review and discussions in the Team sessions, and the pros and cons of all the possible changes were evaluated.

The main end users of the substation premises were those in the Transmission and Distribution Departments, and therefore their views were often consulted throughout the exercise, to ensure final acceptance. The fact that they had representatives in the Team facilitated such consultation.

The following are some examples of the changes that the Team have considered in the process:

1. Reducing the equipment room size to the minimum acceptable, without compromising the safety standard, one example being the 132 kV switchgear room, with width reduced from 13.5 m to 11.5 m;

2. Raising the cable basement level, by having half its height exposed above ground level, so as to reduce the excavation work and hence the cost;

3. Reducing the headroom for the switchgear room was considered, but this was finally rejected due to possible threat to the safety standard by restricting the lifting crane capacity and lifting clearance; and

4. Installing some of the equipment outdoor for reducing the civil work volume, but this was finally rejected due to overall saving in civil cost could not off-set the increase in equipment cost to make it weather proof; and the increase in the maintenance cost.

The other cost reduction opportunities were investigated by

the Team in very similar manner.

The process of reviewing and finalizing recommendations for the cost reduction measures took about eight Team sessions. In some of the sessions, the Team also reviewed other improvement areas related to the project handling processes, which were not necessarily contributing to project cost reduction in a direct way, but was considered significant to the long term project performance.

For example, the Team had reviewed the comment handling process of TPD during project execution. These comments represent in most cases the feedback from the various users on the engineering output of TPD. The Team tried to quantify the numbers of comments received typically per different kinds of output at various stages of the project, with the aims:

1. to reduce the chance for these comments to be repeated; and

2. to investigate ways for these comments to be best dealt with and responded to in general terms.

The Team also reviewed the project process time required by typical transmission substation projects, and the ways of reducing such process time, without sacrificing the other quality requirements. However, due to the time constraint under which the Team had set for themselves concerning the project cost issues, no solid conclusions had been made with regard to the project time issue.

Team Recommendation and Presentation

As mentioned above, the Team had scheduled to present their output to the Quality Council in three sessions, which they named as the interacting sessions. All members of the Team and the Quality

Council attended these sessions. Representatives from the Senior Quality Council and the Corporate Development Department were also present.

In the first of these interacting sessions, the Team presented their proposed time schedule and the results of their study on the project process. The Process Map (Appendix 10) and the various "mile-stones" (or key activities) there-of were explained to the Council members. The Pareto chart of the project costs (Appendix 11) was also presented. Endorsement of the time schedule was given by the Quality Council.

In the second interacting session, the up-dated time schedule of the Team and the progress were reported. These were followed by the presentation of the improvement opportunities identified as related to project cost reduction. The team process, as regarding how the improvement opportunities were derived, was also briefly explained in the presentation. In this session, the feedback from the Quality Council to the Team was formally recorded, and this was taken as some kind of guidance for the subsequent process of the Team. The Quality Council also endorsed the top eight items of the prioritized list of cost reduction opportunities for the Team to pursue on.

The third interacting session, which took place on June 20, 1992, was when the Team presented their final recommendation. The basic content of their recommendation is summarized below.

The Team recommended to implement the eight project cost reduction items as listed below, with an estimated total annual saving of HK$ 40 million (1992 price), and at a time scale as shown in Table 4.1 below.

TABLE 4.1

PROJECT COST REDUCTION RECOMMENDATION

Description	Estimated Annual Saving ($)	Recommended Implementation Time
1) Reduced substation size	29m	Now (1996 projects)
2) Substation decoration	5m	Now
3) Delete standby control panels	2.5m	Now (1995 projects)
4) Delete low smoke cables	1.5m	Now
5) Reduce labour cost	1.5m	Now (1995 projects)
6) Delete instrument transformers for some circuits	0.5m	Now (1994 projects)
Total	40.0m (About 10% of total annual substation project costs)	

The above six items were derived from the eight items from the priority list, by grouping some the items (i.e. items 2 and 5 of the original priority list, which concerned the use of special arrangement of equipment for reducing the area requirement, were grouped into item 1 concerning substation size). The timing as shown above basically called for immediate implementation of the recommendation. However, as some of the recommendations will take some time for them to be engineered into the projects, and so the actual time for them to take effect is that shown in brackets.

The Team also presented their recommendation for improvement on the project process, or what they termed as the "Process Map Oriented Improvements". In their recommendation, they stressed very much on strengthening the communication between the various internal parties throughout the project process. They recommended the following to be done :

1. A Technical Committee should be set up with representatives from various concerned departments, responsible for:

- formulating standard user requirements;

- making continuous improvement / updating of the established user requirements in light of changing conditions / technological advancements; and

- establishing effective channels for the exchanging of information and sharing of valuable technical and operational experience among the concerned departments.

2. TPD, besides its normal role of executing project based on the established standards and user requirements, should take the initiative of resolving any deviations and possible non-compliance with the current standards / requirements, through discussions with the relevant parties (via the above Committee, as appropriate), and updating the standards, as necessary.

3. Annual engineering conferences for engineers at various levels from concerned departments should be held to promote familiarization and friendships; to share new technical know-how and experience learnt from past incidents.

The Team also mentioned about the need to work more closely with the external parties, in particular, the government departments, such as Environmental Protection Department and District Land Office; and the equipment suppliers, to enhance mutual understanding and clarify expectation.

Implementation

In the presentation of their recommendation, the Team apparently did not document in detail any proposed implementation action plan. Most of the implementation details in this particular section have been gathered through interviewing the Team members.

There are basically three means through which the project cost reduction proposals are being realized.

The first means will be the use of standard layout drawings. TPD used to provide typical substation layout drawing for negotiating with the Government for land grant. Therefore, by incorporating the cost reduction layout design into the typical layout drawing, and making them the new standards, the changes will be automatically get implemented. To quote one example cited by one of the Team members, the previous "standard" dimensions that TPD used for obtaining a primary substation site measured 66m by 41m, and the new standard after incorporating the cost reduction layout became 57m by 31.5m. It represents about 33% reduction in site area.

The second means of implementing the cost reduction recommendation will be through revising or producing the appropriate standard documentation. According to a senior staff member of TPD, there are several kinds of standard documentation in use, namely, the Design Code of Practice, the Standard Specifications and the Standard Schemes. Most of the cost reduction proposal will have effect on these documents. For example, the new equipment room dimensions and the deletion of the low smoke cables will be incorporated into the Design Code of Practice. The items regarding the deletion of the standby control panels and the instrument transformers will be incorporated into the Standard Specifications for the concerned equipment and the Standard Schemes.

The third means of implementation, is through reviewing the project budget, which according to one senior member of TPD, is the

most effective means. Two types of budget submission are affected. The first one is the individual project budgets. For all those projects which the above cost reduction measures can be captured in time, the relevant project budgets will be adjusted down to reflect the changes in the appropriate planning cycle. The second type of budget submission is the budget unit rates being used by the Planning Department for modeling and analyzing the financial outlook. These unit rates are submitted by the line departments based on the budget items under their control, and for TPD, they are broken down into equipment, circuit and substation types. New budget unit rates based on the recommended cost reduction measures have since been prepared and submitted, and have become effective after approval by the management.

View-points of the Team Members

Most of the comments from the team members on the TQM team process are on the positive side. All the members considered the process to be a successful one, and that they had achieved their target. The benefits of the team process, as cited by many team members, were that it enhanced communication and cooperation across functional boundaries, it promoted team-work and participative approach in problem solving and decision making, it provided training on quality management tools and other useful problem solving / decision making techniques together with the chance for them to be applied. The Team Charter was viewed by the members as a challenging one, requiring them to exercise their innovative thinking and to appreciate and comprehend the way that other parts of the organization were functioning.

However, there were also a few negative comments made by the members, and they were:

1. Time constraint

Although the time schedule (Appendix 9) was decided by the team during the initial team meetings, some team members considered that they did not do it completely free-handed. Influence from the top prevailed through the "links" with the Quality Council and even the Senior Quality Council. This ended up with a schedule less then 20 weeks, and was not considered to be providing ample time for the whole process, which included running-in, training, task understanding, data collection and analysis, solution generation and evaluation, implementation plan development, and preparation for presentation to the Council.

Nevertheless, as admitted by several team members, the time constraint was to some extent alleviated by the fact that the Team was constituted by members who were acquainted with each other and were familiar with the transmission project activities. The "learning curve", as far as the subject task was concerned, had therefore taken very little time.

2. Authority issue

The members of the Team were amongst the section head, or sub-section head level in the respective departments, and were belonging to the middle to junior management level of CLP. As such, and also coupled with the fact that the whole TQM program had full management support under the directive of the Quality Council and Senior Quality Council, there should be sufficient legitimate authority base for the Team to work on. However, there was at one time a concern amongst some of the members that they lacked sufficient

authority to commit on changes on behalf of the departments which they represented.

Such a concern about authority tended to retard on the team process. One example quoted by a team member was that, the decision to reduce the standard headroom of substation basement, for reducing civil cost was delayed, as one member from the user department refrained from committing without consulting the other sections in his department. Such consultation, as commented by the member citing this example, was not a technical one, but merely a confirmation of authority.

3. Target

Many members considered the 20% reduction of project cost to be too high a target for the Team, and it had imposed quite a pressure on the members at the outset. At one time, some of the members had desired to spend time to prove that the project expenditure was already on the low side, and that the cost within TPD or even CLP's control would be less than 20%, to show how unrealistic the target was. Nevertheless, consensus was reached very quickly within the Team that they should pursue positively, and spend their time constructively to identify all possible cost reduction opportunities, under the given constraints. Meanwhile, reconciliation had obtained from the Quality Council in endorsing their approach, i.e. concentrating on the substation projects, and proceeding within the proposed time schedule, even it ended up with only a partial fulfillment of the target.

4. Nature of the subject matter

The subject matter tackled by the Team was one concerning capital development projects, within a multi-project management setting. The general concern amongst the team members, particularly

at the initial stage, was regarding the application of the quality management approach to such subject matter. The quality tools and concepts, which had proven application in the manufacturing and service industries, might not be so easily adaptable to a project management situation. The difficulties as cited by some of the team members are :

(a) Difficult to measure project quality or performance on a quantitative scale, for the application of the statistical tools;

(b) Difficult to do "bench-marking" as most project situations are very unique; and

(c) Difficult to track and analyze variances, due to the dynamic and unique nature of each project.

Despite the above difficulties, the general comment from most of the team members was that the process was a successful and valuable experience. Most of them admitted that, apart from the technical achievement, there were fundamental changes in their attitude.

Further Development

The above implementation details were reported by the Team to the Quality Council in the last reporting session, which also represented the last activity of the Team according to the time schedule.

The other recommendation of the Team, i.e. the establishment of a Technical Committee, is being coordinated by a senior staff of TPD, in liaison with the other staff members from the Departments concerned.

Most members of the Pilot Improvement Team are now serving other functions under the TQM structure of CLP. Some have been

trained as trainers for running the TQM training courses, while some have become facilitators of the other Improvement Teams, and some have been elected members of these Teams.

According to a member of the TQM Specialist Team under the Corporate Development Department, there are now more than ten Improvement Teams in action, in CLP as a whole. Some of them were initiated by the Departments, or even the Branches themselves, and some were under the direction of the Senior Quality Council members.

A large scale employee survey will be conducted, with the help of external specialist, in early 1993. The survey, according to a member of the TQM Specialist Team, is to find out how employees view the Company and to highlight areas in which they see the need to improve. A customer survey will also be conducted at about the same time.

CHAPTER V

DISCUSSION

The case findings are discussed below, with particular reference to the philosophies and principles as set out in Chapter 3 to determine the extent the latter are adhered to. Some of the key issues addressed and the results so far attained are discussed, and compared with those of the TQM examples as discussed in Chapter Three, so as to determine how they are contingent to the case setting.

Adherence to Deming's Fourteen Points

Deming's Fourteen Points are very philosophical in nature and broad in scope. By gauging some of the case findings with the Fourteen Points, it will help to assess the TQM practice of CLP on a philosophical basis.

The formulation of the vision and mission statements by CLP top management is to certain extent a manifestation of Deming's 1st Point - "constancy of purpose". The setting up of the Corporate Development Department also illustrated the commitment of CLP to the TQM implementation.

Deming's 2nd Point about the "adopting the new philosophy" is not so apparent in the case of CLP. However, it is said that the adoption of the TQM concept is in itself a fulfillment of this point, to quote a comment from CLP's Managing Director in a public speech: "In the past, we, in the utility field could simply believe we

understood our customers' needs. After all, they wanted electricity... as long as we gave it to them with a few interruptions, we were doing our jobs, and in exchange they paid whatever rate was asked...Now, we need to think of quality as the only way to do business. The adoption of a quality strategy is the way to meet customers' wants, needs and expectations."

Deming's Point on ceasing dependence on mass inspection may not have direct application to a utility setting same as CLP. However, relevance does exist, as one important philosophical implication is that quality does not come from inspection, but from improvement of the process (Deming 1982). In the TQM program of CLP, emphasis was put on the improvement of the job processes. In particular, it is one of the task of Improvement Team to analysis the project process for improvement opportunities.

Deming's assertion to end the practice of awarding business on price tag alone is not so easy for a public utility to follow. CLP's situation is similar to that of a governmental set-up, all major business transactions and contract awards need to be justified not only to the investors but also to the public, on an objective basis. The obvious objective criteria for awarding business lies on the bidding price, and it has been the practice of CLP to award contracts to the lowest bidders.

However, there are signs that some fundamental changes are taking place, especially in the subject Department - TPD, with regard to the procurement philosophy. As revealed by a senior staff of the Department, all the contract specification has now incorporated with ISO 9000 standard as the minimum quality requirement, and one of the prequalification criteria is that the vendors are accredited for compliance by a authoritative body.

Long term contracts have been used with great success. Equipment required by projects are procured by means of "call-off orders" as when required under bulk purchase contracts, which enable not only prices to be controlled, but also long term buyer-supplier relationship to be established for all possible quality improvement cooperation.

The 5th Point of Deming on constantly and forever improve the product / service system has met with much emphasis in CLP's TQM practice. It has been embedded as one of the very basic philosophies in the training manual, that the attainment of the TQM objective is through continuous improvement to meet or exceed customer expectations.

Both the 6th and the 13th Points of Deming are concerned with training, and not only the importance of training is asserted, but also the importance for the training to be quality oriented. The finding revealed that both CLP as a whole and the subject Department - TPD, have been very actively pursuing many in-house development and training programs for its staff. As remarked by CLP's former General Manager addressing at the receipt of the 1990 Award for Excellence in Management Development: "CLP's training programs have been successful in ensuring a high standard of service to customers and in helping to combat the brain drain problems."

Training has also been a very basic requirement in launching the TQM program in CLP. As mentioned in the previous Chapter, besides providing the quality technique training for the various Improvement Team members, Quality Council members, and internal facilitators, CLP management has planned to provide Total Quality

Awareness training to every one of the 6000 and more employees. CLP's adherence to these two points of Deming's is rather substantial.

The 7th of Deming's Fourteen Points on modern methods of supervision is apparent in CLP's TQM approach, which is founded on Improvement Teams involving employees of the working level. However, as commented by one of the Pilot Improvement Team members, the way that the Team was formed and the Team Charter that was assigned were of a "top-down" approach. There seems to be insufficient employee involvement in those areas. Juran had, however, a different angle of looking at it, as discussed in the later section of Implementation Framework.

"Drive out fear" is another very philosophical Point of Deming. As inferred from Deming's own elaboration noted in Chapter Three, fear can exist in every level of an organization, when communication channels are not open and the perceived roles of the employees are ambiguous. This is a rather long term issue concerning the culture of the organization. For CLP where the TQM has just at the starting point, the effect on such cultural issue is still superficial. For example, one Pilot Improvement Team member representing a user department has expressed concern that, his role as "linking-pin" between the Team and his own department is sometimes bound by his "perceived authority".

Deming's 9th Point on breaking down barriers between staff areas was manifested in the TQM practice of CLP in two ways. The first is the concept about "internal customer and supplier" which has received much emphasis in the Total Quality Awareness training. The major implication is that the right quality can only reach CLP's

external customer through satisfied internal customer. In one seminar address titled "Creating Competitive Advantage Through Quality", the Managing Director of CLP said: "Inside our organizations, we are customers of other departments and work units. These 'people' elements of the chain, employee satisfactions and retention and the provision of both external and internal customer service must be emphasized if a company wishes to be successful in implementing quality." This internal supplier-customer concept helps to bring down the barriers in the staff areas.

The second concept that CLP is manifesting Deming's 9th Point is the cross-functional Improvement Team practice. Through such practice, members of different functions can learn the problems of each other and altogether contributing to the cross-functional processes which need improving.

The 10th and the 11th Points of Deming are for eliminating numerical goals and numerical quotas / standards. On the face of it, these Points seem to contravene the Management-By-Objective concept. But when the elaboration of Deming is reviewed as set out in Chapter Three, they can be seen as fostering the previous points of continuous process improvement, which is part of the TQM foundation for CLP's case.

The 12th Point, which in Deming's words, reads "remove barriers that hinder the hourly worker", can be extended philosophically to mean removing by management any systems (rules, regulations, policies, formalities, structure, etc.) which counter act the quality effort of the employees. There is, however, no apparent indication as to how this Point is adhered to by CLP. There exists parallelism between this and the situation related to the 8th Point

(drive out fear), such that the "barriers" have yet to be disclosed by the employees through an open communication channel, when the right system and culture are in place.

The last Point of Deming is concerned with the way that the above thirteen Points are put into effect, on a continuous basis. In the case of CLP, this will be discussed under the Implementation Framework that follows.

Implementation Framework

In terms of implementation, the CLP case can be viewed from two perspectives: the macro perspective concerning the implementation of the TQM program in the Company as a whole, and then the narrower one concerning the TQM activities under the Transmission Project Department and the Pilot Improvement Team. They are assessed with reference to Crosby's Fourteen Steps and Juran's Trilogy and Tripol model, which are very much implementation oriented.

From the macro perspective, the TQM implementation of CLP followed quite closely most of the steps of Crosby's Fourteen Steps. Apparent examples are: Management Commitment (Step One), Quality Improvement Team (Step Two), Quality Awareness (Step Five), Employee Training (Step Eight), Quality Councils (Step Thirteen) and Do-it-over-again (Step Fourteen). It should be noted that the Quality Councils in Crosby's Step Thirteen are constituted by professional quality people, who are sources of information and action. In the case of CLP, the Quality Councils and Senior Quality Councils consist of senior members of the organization, which are more like Juran's "Managerial Teams" (Juran 1979).

Some of the CLP's TQM practices at the department and team levels correspond to the other Crosby's Steps. Quality Measurement (Step Three), Cost of Quality (Step Four), Corrective Action (Step Six) and Goal Setting (Step Ten) were practised by the Pilot Improvement Team in tackling the task of cost reduction. This will be further discussed in the later section on the Cost Reduction Issue.

At the departmental level, the Team Charter which conveys the performance requirement to the Team is manifestation of Zero Defects Planning (Step Seven) of Crosby. The "Zero Defect" Day (Step Nine) is analogous to the instance when Quality Council endorsed the Team's recommendations and committed themselves to the implementation. Error-Cause Removal (Step Eleven) and Recognition (Step Twelve) are being practised on a on-going basis through feed-back from department staff members to the department management and vice-versa, during the implementation of the recommendation.

There exist similarities between Juran's Trilogy / Tripol models as discussed in Chapter Three and CLP's case, in terms of the TQM implementation at the department and team levels. The Quality Council, Project Team and Team Charter, which are names used in Juran's models, have the same application in CLP's case.

The "Supplier-Processor-Customer" concept in Juran's Tripol model has also application in CLP's cross-functional Improvement Team, whereby the requirements of the "internal customer" and the capacity of the "internal supplier" are identified and reconciled in the team process. Such a cross-functional team operation helps to resolve the phenomenon which Juran called the "internal monopoly".

In terms of setting measurable targets for the purpose of control, and establishing infrastructure for quality improvement

program, the mode of implementation in the CLP's case aligns with Juran's Trilogy, which advocates the upper management initiative, coupled with upper management representation in the Quality Council. Such a top-down approach of Juran is based on the Japanese experience, as Juran has described that "upper management in charge" is the creation of unprecedented strategies of the Japanese revolution in quality (Juran 1979).

Some of the quality planning tools e.g. flow diagram and Pareto diagram, as suggested by Juran's Trilogy have been used by the Team for identifying and prioritizing quality objectives for reducing project costs. The selection of project cost reduction as the Team Charter for the Improvement Team in CLP's case, is to certain extent fulfillment of Juran's suggestion that a "winner project" should be used as the starter. As a starter, the project cost reduction task satisfies most of Juran's criteria, as it deals a chronic problem, it is feasible, significant and measurable.

The Cost Reduction Issue

The chronic nature of the project cost issue and its significance is revealed by the many times that the issue has been addressed in the various documentation / occasions as mentioned in the last chapter. The fact that the cost effectiveness issue was addressed in TPD's Safety Implementation Policy in early 1991 illustrated TPD's concern for cost.

The choice of adopting cost reduction as the Team Charter is also in line with the Company's mission statement (Appendix 4), which says: "...to provide the community with an essential service by converting primary energy into electricity in the most efficient and

cost-effective way.... , it is essential to ensure the profitability of our company with tariffs at the lowest possible level."

The project cost reduction theme has in fact a positive impact on tariff level, and can contribute towards satisfying the "external customers" in the public. According to the Scheme of Control Agreement between CLP and the Hong Kong Government, CLP is entitled to a permitted return calculated as[1] :

(a) 13.5% of the total value of the average net fixed assets; and

(b) 1.5% of the shareholders' investments made after 30th September 1978 for acquiring fixed assets.

In simple terms, every dollar in the capital expenditure of CLP will constitute 15 cents of the permitted return, which will be reflected in the tariff to be borne by the customer. Therefore by reducing the capital expenditure, the burden on the tariff will be reduced, and the customers will ultimately benefit from it.

It now comes the question as to how much cost should be reduced. The Team Charter has put forth a figure of 20%. When the Team members were asked, most of them considered the target to be too high, but they saw no harm to aim high, and after their team process, they would counter propose a practical achievable figure for the Quality Council to endorse. A member of the Quality Council admitted that the 20% figure is for the Team to aim high, and that the Quality Council would support a realistic figure based on the Team's analysis. He commented: "What percentage figure is not the crux. The most important thing is for the team to review the whole project process, to identify real cost saving opportunities and

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[1]Reference: The Scheme of Control Agreement signed in March, 1992.

practical work plan, through a participative approach." This basically outlined the spirit behind the Team Charter.

The Team Charter also required that the recommendations made by the team must not compromise safety standards or change the 10-year transmission plan, and must be within statutory requirements. Such provisions are to certain extent prioritize the factors of concern as mentioned in the last chapter. For example, time is a prioritized factor such that the project progress must not fall behind what is required by the transmission plan; and environment protection is also amongst the top of the list so far as the statutory provisions are concerned.

All of the above constitute to the constraints for the cost reduction considerations. However, as one of the member of the Team has pointed out, these constraints should not limit the cost reduction ideas and effort, as what they should be looking for are less costly ways of meeting these constraints, and eliminate / reduce margins which they have over-provided.

Instead of viewing the various factors as constraints, they can in fact be seen as means of reducing or controlling project costs, and helping to implement other TQM goals. They are discussed below, following the same order as in Chapter Three, where these factors are presented as regards to their relationship to the project process:

1. Time factor

As mentioned above, the time factor for project work takes the forms of project programs / schedules. Instead of being perceived as merely a constraint to project activities, they should be seen as means of monitoring project performance, in particular in controlling project costs. An out-of-control project program is often accompanied

by an increase in project costs. For example, delay in placing an order for equipment can lead to escalation adjustment of the equipment price; delay in completion of the substation building can incur storage cost for equipment waiting for access to the site, or claim by the erection contractors for their waiting time; and so on.

The above is best illustrated by a widely used integrated cost / schedule control and reporting tool for capital development project, mostly known as the S-curve (Miskawi 1989). A typical S-curve for a project from inception to completion is shown below:

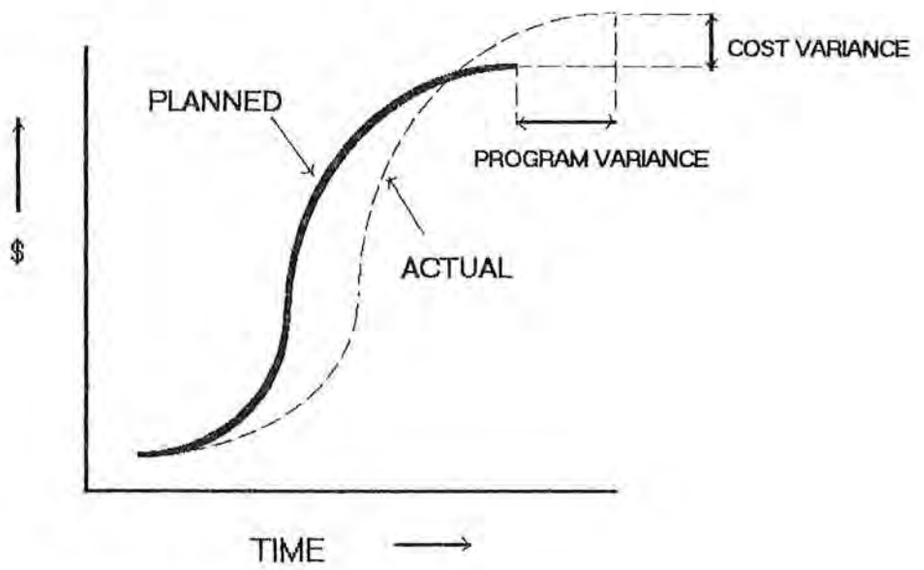


Fig.5.1. Typical "S-curve" of a Project

It is evidenced that early control of the program can help to bring the overall project cost under control, and by shortening the whole S-curve, the overall project cost can be reduced. The computerization move of TPD in integrating the project program and budget monitoring as mentioned in Chapter Four, is to some extent providing overall project control in line with the above format.

One recommendation from the Team concerning labour

cost did utilize the time factor, whereby labour-force deployment should be based on a coordinated program, such that the peak requirement can be smoothed out to minimize the total labour demand.

2. Human factor

Human factor can be very costly if not well developed, well led and well deployed. One recommendation of the Pilot Improvement Team as mentioned above is regarding cost-effective labour deployment, but it should be noted that training, leadership and employee involvement are equally important. The Pilot Improvement Team itself is a good example of a value-added human factor process, where the team is trained, led and it interacts to come up with valuable and workable solutions to the cost reduction issues. The same approach can be applied to many other issues, and involvement of even lower level in the organization can sometimes be valuable, especially on issues directly affecting them.

3. User requirement

The users of projects constitute the "internal customers" of TPD. All the cost reduction measures will fail if at the end they cannot satisfy the need of these internal customers. Such failure may not only counter the desired reducing effect, but may overshoot above the original cost. Cost increase of such kind is analogous to Feigenbaum's internal and external failure costs.

Taking the case of reducing substation size as an example. The reduction would led to smaller building volume - saving in civil cost, and smaller site requirement - saving in land cost. However, if this results in sacrifice in the operation and maintenance areas to beyond the user's minimum requirement, any subsequent remedial change can be very costly.

To avoid such happening, close liaison with the users and early involvement of them in the conceptual stage is of paramount importance. This is the real significance for the TQM team to be represented by the "internal customers".

4. Contractor performance

Quite a number of the cost reduction proposal would require the input from the equipment supplying contractor, in terms of changing the equipment design and application scheme. Extra costs may thereby incur due to extra engineering input and extra checking effort. They are analogous to Feigenbaum's prevention and appraisal costs. One example quoted by a member of the Team was regarding the recommendation to delete the "standby control facilities". He admitted that such facilities were redundant, but the deletion was no simple task, as many associated changes were involved.

Long term relationship with the contractor contributes significantly in such situation. Firstly, there is always a learning curve to go through in adapting to the changes, and short term contract provides no incentive for the contractor to incorporate the change, without requiring significant compensation for the learning effort. Secondly, through a long term relationship, the contractor can be made more conversant with the purchaser's requirement, and the purchaser can become familiar with the strength and weakness of the contractor. Therefore, the cost reduction changes can be implemented more smoothly, with less checking effort, and thus lower appraisal cost.

5. Safety

Cost of safety cuts across the whole spectrum of Feigenbaum's quality costs. In ensuring on-site safety, TPD provided safety

inspectors to detect any unsafe situation and making sure all safety measures are incorporated and safety harness is made available. Prevention and appraisal costs therefore incur. When accident happens, the man-hour loss, the compensation, the remedial measures, etc. belong to the failure costs. Some of such costs can be intangible, e.g. the bad social image, ill feeling and low morale of employees when accident occurred.

For obvious reasons such as the above, the Team Charter was built in with the requirement that no safety standard should be compromised. However, there is no apparent evidence as regarding how the evaluation of the impact on safety is evaluated by the Team. According to a Team member that, in their process, any cost reduction possibility which appeared to have adverse implication on safety was immediately rejected.

6. Environmental protection

Like safety, environmental issues can result in very high intangible costs, such as social image. Most of the environmental protection requirements to be complied with during project execution, are written into law, or in the conditions imposed by government, when granting substation site or pylon site. Compliance with the statutory requirement as stated in the Team Charter is deemed to be covering issues of this kind.

There are various ways of complying with the environmental requirements, and they involve costs of different nature. In general, prevention cost is lower than failure cost. One example is the treatment of noise emitted from transmission substation, where the noisiest equipment is the transformer. As apparent from TPD's code of practice, their approach is to standardize on using "low noise"

type transformer for every substation site. This low noise specification costs about a few percent more than the "normal" design, but is much cheaper than the later addition of noise enclosure, when noise complaint arises after commissioning.

Therefore, many factors affecting project performance do have repercussion on project costs. Costs reduction approach by addressing only some of the above factors, without overall evaluation of the other effects can lead to partial accomplishment of the total quality goal.

Totality of TQM

Feigenbaum has given a very sound argument for the totality of quality management, as he said: "... fragmented quality activities in the corporation generated many quality problems that were often self-created by the looseness of the corporation's quality actions." (Feigenbaum 1983)

The totality of the TQM program of CLP can be examined from three domains: the totality over the organization, totality over time, and totality over the process.

Totality over the organization is one of the most important aspects of many TQM programs. The total quality control concept of Feigenbaum and Ishikawa is centered on the totality over the whole organization. Feigenbaum illustrated the problem due to the lack of totality over the organization, by citing the ancient fable of the four blind men feeling the elephant at different areas (Feigenbaum 1983).

In terms of TQM practice, the use of inter-departmental team and internal supplier-customer process is subscribing to the concept of totality over the organization. As revealed in the TQM examples in Chapter Three and many others, inter-departmental or cross-

functional team-work, internal customer satisfaction and the like, are amongst the most frequently addressed issues.

For the case of CLP, the TQM training manual begins by explaining the term "total" to mean: "Every department, every level...", and this illustrates the emphasis attached to the totality over organization concept in CLP's TQM program. The across-department nature of the Quality Councils and the Improvement Teams are ways adopted by CLP in implementing such concept.

The significance of the cross-functional membership in the Pilot Improvement Team has been discussed above. However, the concern of authority by some team members as mentioned in Chapter Four does bring out another issue, i.e. the degree of empowerment and the commitment of upper management.

The cross-functional team is a kind of horizontal integration of efforts across departmental boundaries, which contribute to the cooperation and coordination required for all project execution processes. On the other, vertical integration in terms of empowerment, endorsement and recognition across levels in the organizational hierarchy, is also a prerequisite for successful TQM effort.

As evidenced in the case of the Pilot Improvement Team of CLP, the recommendations from the team represent some kind of innovative break-throughs for tackling the chronicle cost issue. Such break-throughs bound to meet with resistance from the out-team members, and will require both the persuasive effort from the in-team members plus authority delegated from the top, in order to get the changes enforced.

The vertical integration of TQM effort as in the case of CLP is

to some extent working through the Quality Council and the Senior Council, and through the "linking-pins" between the various membership. However, the complete fulfillment of the totality over the organization can only be achieved when the TQM concept is embedded as part of the overall organization culture, and for CLP, it is still under the test of time.

The totality over time is perhaps the most challenging test for every TQM program. The long term nature of TQM effort has been addressed in a lot of literature and articles about TQM. As Deming put it: "there is no instant pudding". A comparison study between Quality Circle and TQM showed that the "quick fix" mentality is not to work for TQM, and some companies have actually spent several years on preparatory work before introducing the scheme (Hill 1991).

The totality over time concept is founded on the very first point of Deming's Fourteen Points, and is achieved by an organization's long term pursuance of the continuous improvement effort. There exists established approach in terms of implementation, e.g. the Shewhart (Deming) Cycle of Plan-Do-Check-Act, or the vital step in Crosby's implementation model: "Do it all over again". In Ishikawa's book on "What Is Total Quality Control?", the Plan-Do-Check-Act Cycle is showed diagramatically as an all-embracing function in the company-wide quality control activities, signifying the need for "the wheel to turn over and over again to prevent recurrence of defects at all levels" (Ishikawa 1985).

Like many other TQM programs, continuous improvement is stressed in CLP's case in many instances, e.g. in the TQM training manual, where the term quality is elaborated as "making continuous improvement to meet or exceed customer expectations ...".

As regarding the Pilot Improvement Team, their existence appears to be short-lived. However, the output of the Team does have long term effect. Many of the project cost reduction measures recommended by the Team have been incorporated into the standards and the design codes of practices, and the new standard budget rates have been established based on the new practice. All these have created a long term basis for the future implementation and maintenance of the Team's recommendations, and any further improvement can be made on such basis.

Further improvement in future was actually anticipated by the Team, as the Team recommended the permanent setup of a Technical Committee, with the role of making continuous improvement / updating of the established user requirements in light of changing conditions / technological advancements.

The third totality domain is concerned with the totality over the processes. Two considerations are evident for this domain, one concerning the ability to cover all processes, and the other concerning the thoroughness of applying the quality concept in each process.

According to the TQM training manual of CLP, the word "total" is also assigned to mean "every process". For TPD, which is basically a multi-project management organization, the totality in this sense has particular significance, in that the TQM effort should not only apply to a single project, or the individual activities of a project, but also to all projects. Taking the cost reduction recommendations from the Team as examples, they will only yield very limited benefit if they are applicable to only one or two projects. However, as most of the recommendations are applicable to all similar

projects, and the fact they are written into the standards and codes of practices, and incorporated in the standard budget rates, the totality of the effect is ensured.

The totality regarding thoroughness is to some extent related to the complexity and quantity of issues or factors involved. The various factors as discussed under the cost reduction issues in the last section demonstrate the significance for the TQM effort to be particularly thorough in a project management setting. In considering one particular issue or factor, it may have effect on many others, and suboptimizing may happen, whereby in trying to achieve the desired results for the subject issue, the action may bring about adverse repercussion to the others, or being counter-acted by the others. On the other hand, some factors which may provide good improvement opportunity may be skipped, if the process is not thorough enough. One negative comment on the subject Team process is the lack of thoroughness, which is partly due to the time constraint as discussed above.

CHAPTER VI

CONCLUSION

The conclusion in this chapter is drawn upon the case findings, for providing some insights as regards to the TQM approach of CLP, and to derive relevant implications for future or further TQM efforts, particularly concerning a project management environment.

TQM Approach of CLP

There are as many TQM approaches as there are definitions for the term "quality". Many writers have postulated various TQM models, each containing slightly different emphasis, in relation to different situations and applications.

On a philosophical basis, the TQM approach of CLP as discussed above, exhibits adherence to the Fourteen Points of Deming. As a power supply utility, CLP's operation covers a wide variety of activities, each carries different quality requirements. The Fourteen Points, owing to their broad and philosophical nature, provide the right set of guiding principles relevant to such a wide variety of quality targets.

Gabor in her book on "The Man Who Discovered Quality" has written a chapter on Florida Power and Light (FP&L) - the U.S. power utility who won the Deming Prize. Gabor cited the story of how FP&L learnt the quality lessons from Kansai Electric, a Japanese power supply utility who won the Deming Prize in 1984. In the chapter, a few examples of the quality problems addressed by these

utilities were mentioned, ranging from the false alarms in the power station to the meter reading errors in the district operation, and ranging from project cost control matters to the ways of handling consumer complaints. It demonstrated the needs for a broadly based set of philosophies like those by Deming, to put the whole operation into the right quality perspective. As Gabor has written near the end of the chapter: "... when FP&L received its award in the fall of 1989, it was, in fact, following in the footsteps of Deming's most successful, and beloved, disciples." (Gabor 1990)

The extent to which CLP adheres to each of the Fourteen Points does vary, as discussed in the last chapter. The main snag lies on those areas which require a very long term development of systemic and cultural setting, for example the Eighth Point on "drive out fear" and the Twelve Point on "remove barriers that hinder workmanship". They represent a state that there is completely free flow of information from top to bottom and vice versa, and that the whole work-force is given sufficient authority to tackle problems affecting their work. CLP's TQM program has only been launched for less than two years, and the whole organization is still in the beginning of a "learning process". To attain the state closer to the two points by Deming, CLP has yet to pass a long term, systemic and cultural transformation in a gradual process.

While Deming's Fourteen Points form the philosophical basis for the TQM approach, the ways of implementing them in the organization as a whole are no simple task. For the case of CLP, the TQM implementation generally follows a framework constituted by concepts of Crosby, Juran, Shewhart, Feigenbaum and Ishikawa. Main characteristics of such a framework are:

1. Formulation of company vision and mission statements denoting management's commitment.

2. Three-tier organization: senior quality council, quality council and improvement team, coordinated and facilitated by an expertise group.

3. Company-wide quality awareness training, supplemented by team-work training, quality tool training, team leadership and facilitation training.

4. Cross-functional team approach on improvement projects, which are process oriented and customer focused.

5. Top-down approach in team formation and team charter assignment, and bottom-up approach in team recommendation and implementation.

6. Application of Plan-Do-Check-Act cycle and other quality tools in the improvement processes on a continuous basis.

The above concludes at a macro level, the philosophical basis and the implementation framework of CLP's TQM approach. At a micro level, the process of the pilot improvement team, in dealing with the transmission development project, have provided some more insights concerning the use of TQM approach in a project management setting.

TQM Approach for Project Management

TQM principles and concepts are pertinent to goods and service undertakings, and yet they are extendible to cover application in a project management environment. This is exemplified by the work of the Pilot Improvement Team of CLP, which deals with the project cost issues by applying the TQM approach.

As discussed in the last chapter, the subject task of cost

reduction for the Pilot Improvement Team is a good starter. It satisfies Juran's criteria of being a chronic, significant and measurable task. The project cost issue for CLP has also significant impact on the ultimate customer, through the Scheme of Control tariff mechanism, and thereby contributes to the company quality mission.

The way the task is set into the team charter is also important, as it calls for review of the project process, and it provides the prioritized constraints to ensure no sub-optimization. One questionable aspect is 20% reduction target set in the team charter. It does to some extent violate Deming's Tenth Point: "eliminate numerical goals for the work-force".

The structure of the Improvement Team and Quality Council is particularly relevant to the project management setting. The members of the Team and the Council are from departments which are major parties in the project execution process. Besides being familiar with the project process, and thereby providing valuable input, they also ensure high acceptability of the Team decision. It follows the cross-functional quality concept of Feigenbaum and Ishikawa, and applies the "Supplier-Processor-Customer" model of Juran. It is also a move towards Deming's Nineth Point: "break down barriers between staff areas".

The Team process had utilized several of the quality tools in tackling the task systematically. Brainstorming, fishbone diagram, Pareto analysis and process map were the main tools used. They are not very sophisticated, but are regarded as easy to master and serving the purpose of a project management task. Sophisticated tools, aiming at high accuracy or rigid reference points, are apparently not appropriate for a project management setting, due the

uniqueness of each project and the variety of the influencing factors. It is also apparent from the Team process of the subject case that, the thoroughness of the process is not curtailed by the tools they used, but by the time constraint set for the process.

To be a thorough process, it needs to cover many interrelated factors which contribute to project performance, and have direct impact on the project cost. In the case of the transmission development projects in CLP, the relevant factors include the following:

Time

Human resource

User requirements

Contractor performance

Safety

Environmental protection

These factors are constraints, but at the same time they can be contributing to the process, as either improvement opportunities or indicators for monitoring and control of the project quality. It is also important for the overall result to be evaluated, such that the positive effect in tackling one factor, will not be offset or overtaken by the negative effect created on the other factors.

As regarding the implementation of the Team's recommendation, besides incorporating the changes in the earliest possible current projects, the Team also adjusted the codes of practice, standard specifications and drawings, and standard budget rates, in line with the recommended changes. This approach is particularly effective for a multi-project setup as that of the Transmission Projects Department, to ensure that the future projects will also capture the

improvements. However, it is also important that a review or evaluation mechanism be established, to ensure that there is no unforeseen adverse effect due to the changes and to look for further improvements.

Implications

One contingency theory about TQM approach is postulated by Norman Chorn, which suggested TQM is particular appropriate for (Chorn 1992):

1. Business condition which is of low competitive intensity and low strategic risk;

2. Markets which is mature;

3. Competitive thrust based on long-term customer relationships and operational efficiency;

4. Technology involving well-known processes; and

5. Strategy formulation process which is slow, cautious and conservative.

CLP, and most other regulated utility companies alike, match very closely with the above considerations. However, does it imply all these utilities including CLP, on board of the TQM bandwagon, will excel anyway, in a few years' time. Any management having such a belief has not the right perception about TQM, and it is rather dangerous to commit to any TQM program, without knowing what one is really committing to.

The implication of committing to a TQM program is not simply making a few lines for a company vision and mission statement, taking in a consultant to do a few training courses, and getting together a few employees to do an improvement project.

The implication is that there has to be:

1. Totality over the organization

Adequate resources are in place with sufficient training, well coordinated and well communicated to achieve both a vertical and horizontal integration of quality effort, for the establishment of total quality system and organization culture. Both the hard issues (e.g. tasks, methods, techniques, programs, etc.) and soft-issues (e.g. attitudes, values, behaviors, etc.) are to be attended to.

2. Totality over the processes

All major work processes (or projects) and all relevant performance factor of the processes (or projects) are subject to the total quality improvement effort. The interrelation between processes and / or between factors cannot be ignored.

3. Totality over time

All the above-mentioned effort, whether on an organization basis or on a process basis, has to be put in place, maintained, reinforced and enhanced constantly, and to be subjected to continuous review and sustained improvement, while recognizing and overcoming short-term hardships, frustration, resistance (both within and outside) and mishaps.

To conclude this report and to show some examples of TQM effort which had passed the test of time, I would quote below some statistics from PA Consulting Group, published in Economist - Volume 323 (April 18, 1992), page 18 (under the title "It takes time"):

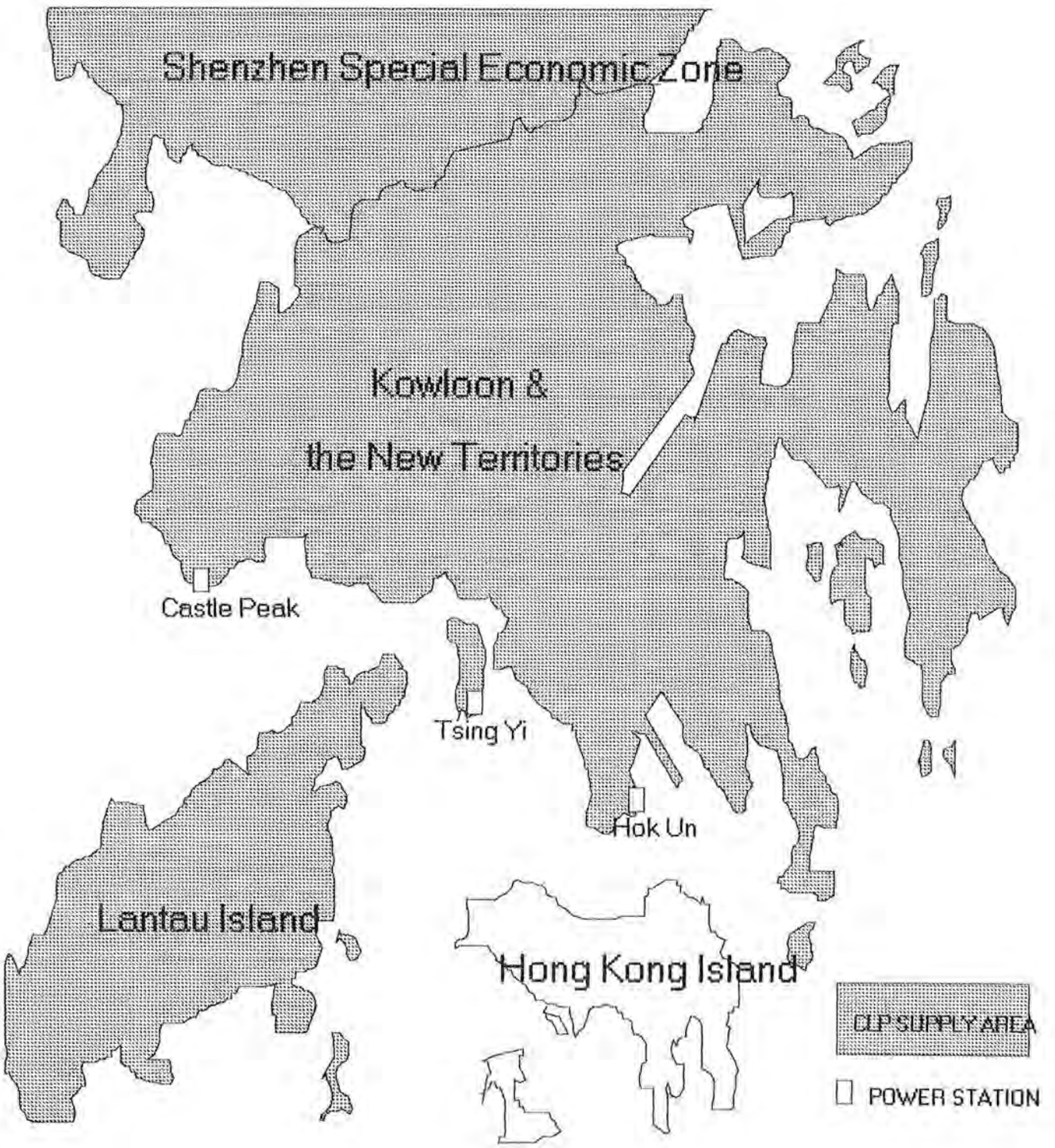
Number of Years' Experience with Total Quality Management

Honda	32 years
Nissin	32 years
Toyota	30 years
Matsushita	28 years
Florida Power & Light	10 years
Texas Instruments	10 years
Xerox	9 years

Therefore CLP is still in its infancy in terms of its TQM experience, and only through a sustained quality effort in the totality sense, will its TQM program lives up with the test of time and yield desired results leading to long term success. This does not only apply to a utility company like CLP, but also to other enterprises, which are pursuing the TQM ways.

APPENDICES

APPENDIX 1 : CLP'S SUPPLY AREA



APPENDIX 2 : SOME OPERATING DATA ABOUT CLP

(Based on 1992 Annual Report of CLP)

Financial Year (ending October)	1991	1992
Turnover	HK$ 11,862 M	13,402 M
Capital Expenditure	HK$ 3,516 M	2,982 M
Net Assets *	HK$ 26,884 M	28,856 M
Net Return *	HK$ 3,715 M	4,047 M
No. of Customers	1,508,611	1,556,775
No. of Employees	6,605	6,587
Monthly Paid Employees	3,374	3,367
Hourly Rated Employees	3,231	3,220
Installed Capacity	6,132 MW	6,432 MW
System Maximum Demand	4,828 MW	5,289 MW
Electricity sales in units (kWh)	20,698 M	23,291 M
Electricity Sales in Dollar Value	HK$ 11,545 M	13,169 M
Electricity Sales Analysis in HK$ M (in %):		
Commercial	3,310 (29%)	3,644 (28%)
Manufacturing	3,030 (26%)	3,000 (23%)
Domestic	2,513 (22%)	2,748 (21%)
Government & Others	1,741 (15%)	1,864 (14%)
China	951 (8%)	1,913 (14%)
Total	11,545(100%)	13,169(100%)

(* Based on Scheme of Control)

APPENDIX 3 : CLP'S VISION

Over the next 10 years the company will double its Generation, Transmission and Distribution capacity requiring substantial investment by our shareholders, changes in corporate structure, more professional management and increased involvement of staff at all levels in order to meet the company's objective.

There will be a strengthened interconnection of CLP's Transmission System with that of Guangdong General Power Company.

CLP will further its international reputation to become one of the world's leading investor-owned utilities renowned for its excellence in Power Station Construction and Operation, Management and Profitability.

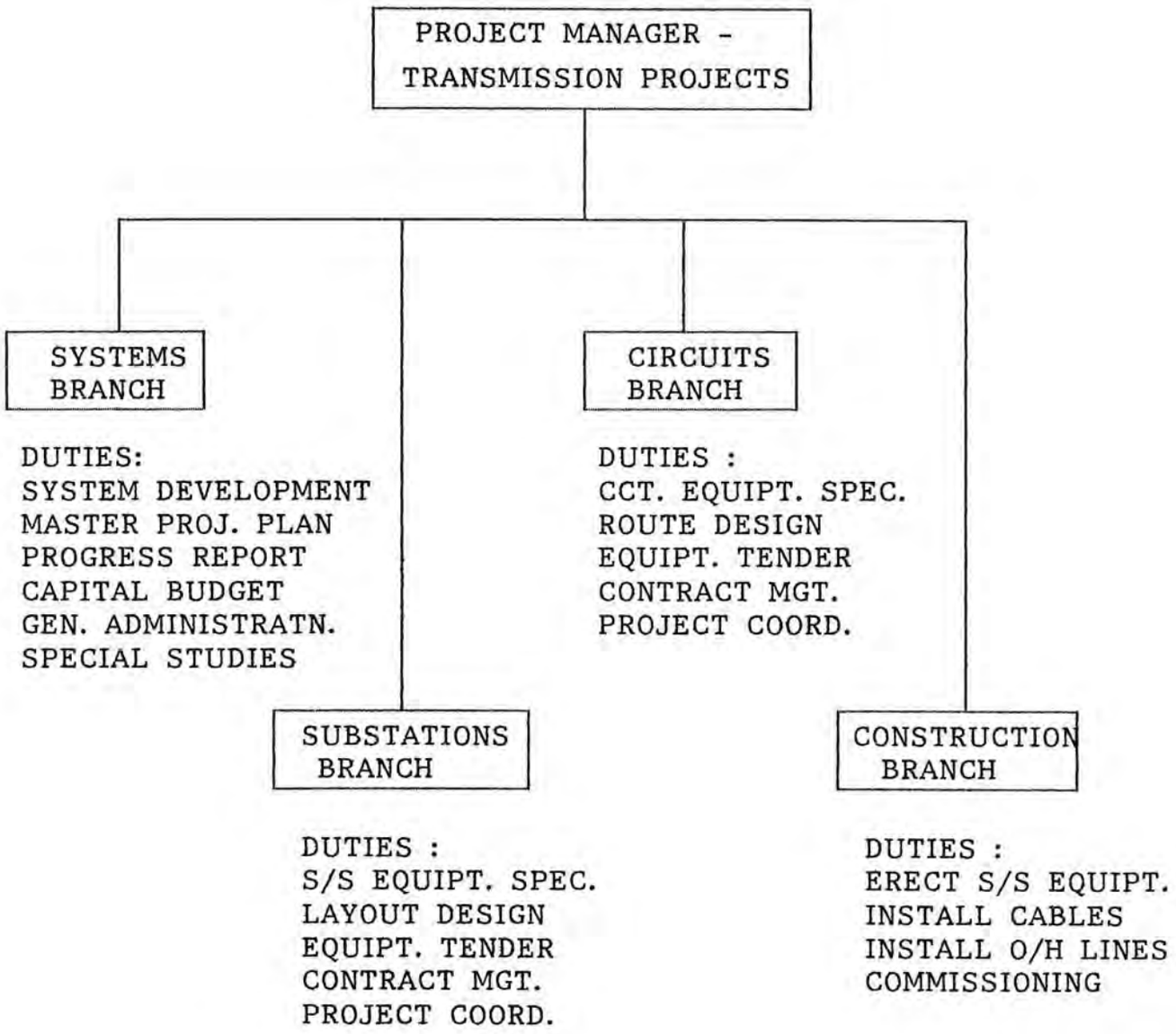
APPENDIX 4 : MISSION STATEMENT OF CLP

Our mission is to provide the community with an essential service by converting primary energy into electricity in the most efficient and cost-effective way having due regard to our responsibility for the environment.

The power generated must then be transferred to our consumers through the company's Transmission and Distribution Systems with minimum losses in order to provide a safe, reliable and secure supply.

In meeting this objective, it is essential to ensure the profitability of our company with tariffs at the lowest possible level.

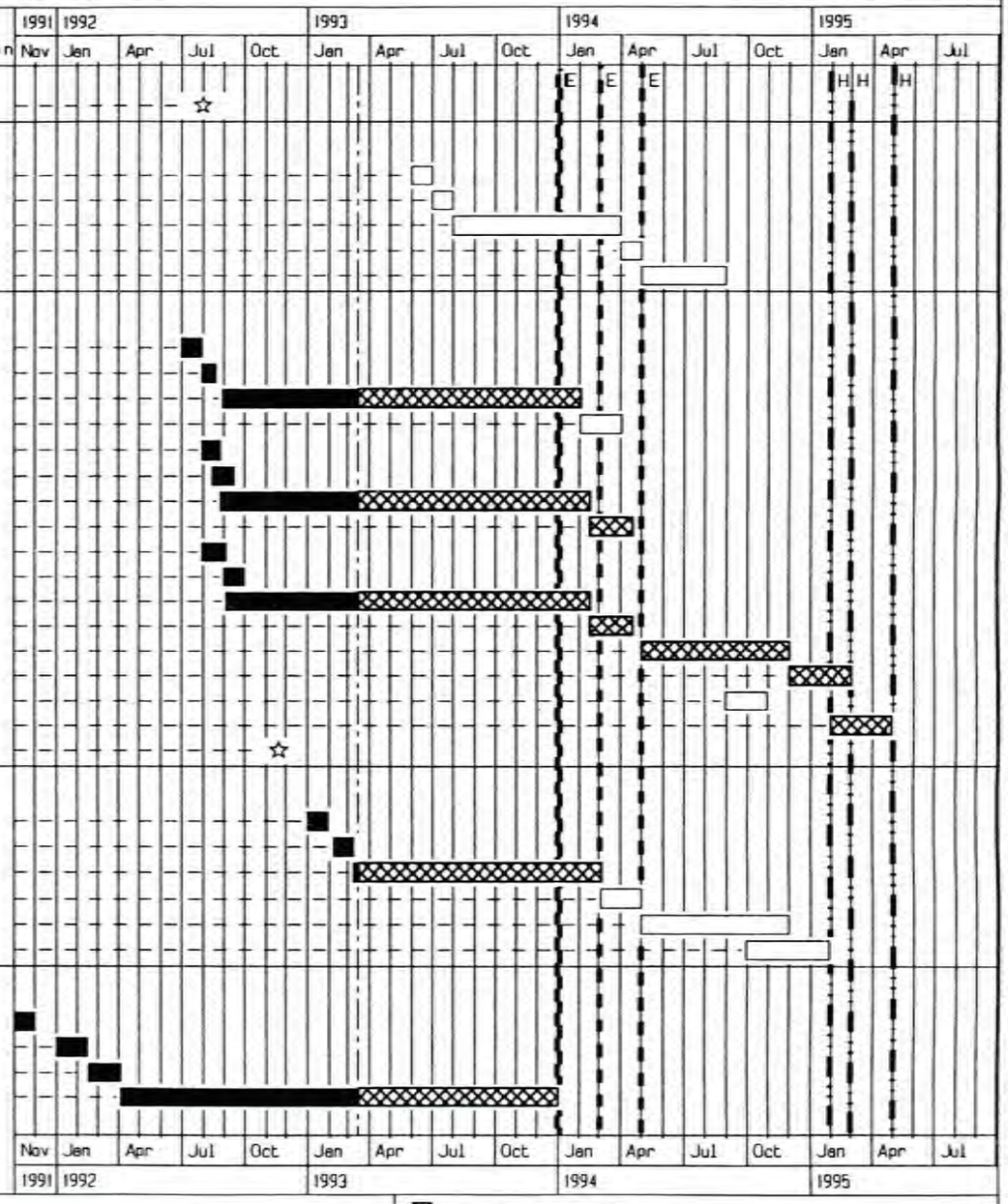
APPENDIX 5 : ORGANIZATION OF TPD



TOTAL NO. OF EMPLOYEES IN TPD : 395 (INCL. 145 MONTHLY PAID STAFF & 250 HOURLY RATED WORKERS)

1995 Project : P04-690 (STAGE 1) Title : TO ESTABLISH YAU MA TEI 400KV S/S Time Now : 15-Mar-93

ID Code	Activity	Section
11537BF	ISSUE 400KV S/G FOUND'TN DETAILS TO CIVIL @ YME	TPSS
	13, DAL BATTERY AND CHARGER	
10554AG	REQUEST TO CALL OFF -BATT.& CHARGER FOR LOA @YME	TPSS
10554AN	ISSUE CALL OFF ORDER-BATT.& CHARGER FOR LOA @YME	TPPR
10554AR	MANUFACTURING -BATT.& CHARGER FOR LOA @YME	TPPR
10554AS	DELIVERY -BATT.& CHARGER FOR LOA @YME	TPPR
10554AT	INSTALL & TEST -BATT. & CHARGER @ YME	TCSS
	14, DBE 400/132KV AUTO-TRANSFORMER	
10547AG	REQUEST TO CALL OFF -1X240MVA 400/132KV TX @ YME	TPSS
10547AN	ISSUE CALL OFF ORDER-1X240MVA 400/132KV TX @ YME	TPPR
10547AR	MANUF(432427/4) -1X240MVA 400/132KV TX @ YME	TPPR
10547AS	DELIV(432427/4) -1X240MVA 400/132KV TX @ YME	TPPR
11547AN	ISSUE COO -1 X 240MVA 400/132KV TX @YME	TPPR
11547AG	REQUEST TO CALL OFF -1 X 240MVA 400/132KV TX @YME	TPSS
11547AR	MANUF (432427/5) -1 X 240MVA 400/132KV TX @ YME	TPPR
11547AS	DELIV (432427/5) -1 X 240MVA 400/132KV TX @ YME	TPPR
12547AN	ISSUE COO -1 X 240MVA 400/132KV TX @ YM	TPPR
12547AG	REQUEST TO CALL OFF -1 X 240MVA 400/132KV TX @YME	TPSS
12547AR	MANUF (432427/6) -1 X 240MVA 400/132KV TX @ YME	TPPR
12547AS	DELIV (432427/6) -1 X 240MVA 400/132KV TX @ YME	TPPR
12547AT	INSTALL -3X240MVA 400/132KV TX @ YME	TCSS
12547AU	TEST -3X240MVA 400/132KV TX @ YME	STPR
13547AT	INSTALL TRUNKING -3X240MVA 400/132KV TX @ YME	TCSS
13547AV	132KV CABLE TERMIN. -3X240MVA 400/132KV TX @ YME	TCCA
14547AF	ISSUE 240MVA TX FOUND'TN DETAILS TO CIVIL @ YME	TPSS
	15, DCA PROTECTION EQUIPMENT	
10560AG	REQUEST TO CALL OFF -132KV PROTN. EQP'T @ YME	TPSS
10560AN	ISSUE CALL OFF ORDER -132KV PROTN. EQP'T @ YME	TPPR
10560AR	MANUF (429330/38) -132KV PROTN. EQP'T @ YME	TPPR
10560AS	DELIV (429330/38) -132KV PROTN. EQP'T @ YME	TPPR
10560AT	INSTALL -132KV PROTN. EQP'T @ YME	TCSS
10560AU	TEST -132KV PROTN. EQP'T @ YME	STPR
	16, DCAG PROTECTION EQUIPMENT (400KV)	
10560GF	AWARD CONTRACT -400KV PROTN EQP'T @ YME	TPSS
10560GG	REQUEST TO CALL OFF -400KV PROTN. EQP'T @ YME	TPSS
10560GN	ISSUE CALL OFF ORDER -400KV PROTN. EQP'T @ YME	TPPR
10560GR	MANUF (436979/3) -400KV PROTN. EQP'T @ YME	TPPR



CRIT NON_CRIT COMPLETE CRIT_KEY NON_CRIT_KEY COMPLETE_KEY

TPD/SYSTEMS BRANCH REMARK : RUN : 22-Apr-1993 13:01 Pg 4 of 8 (04-690/1)

APPENDIX 7 : TEAM CHARTER OF PILOT IMPROVEMENT TEAM

Team Charter

The Transmission team is chartered with the responsibility of documenting and analyzing the current transmission design and engineering process from planning to execution, generating a prioritized list of improvement opportunities, and implementing changes identified as high priority items in order to reduce project costs by 20%. All recommendations made by the team must not compromise safety standards or change the 10 year transmission plan. Recommendations must be within statutory requirements.

APPENDIX 8 : VALUES / GROUND RULES OF THE TEAM

Widen knowledge of team members

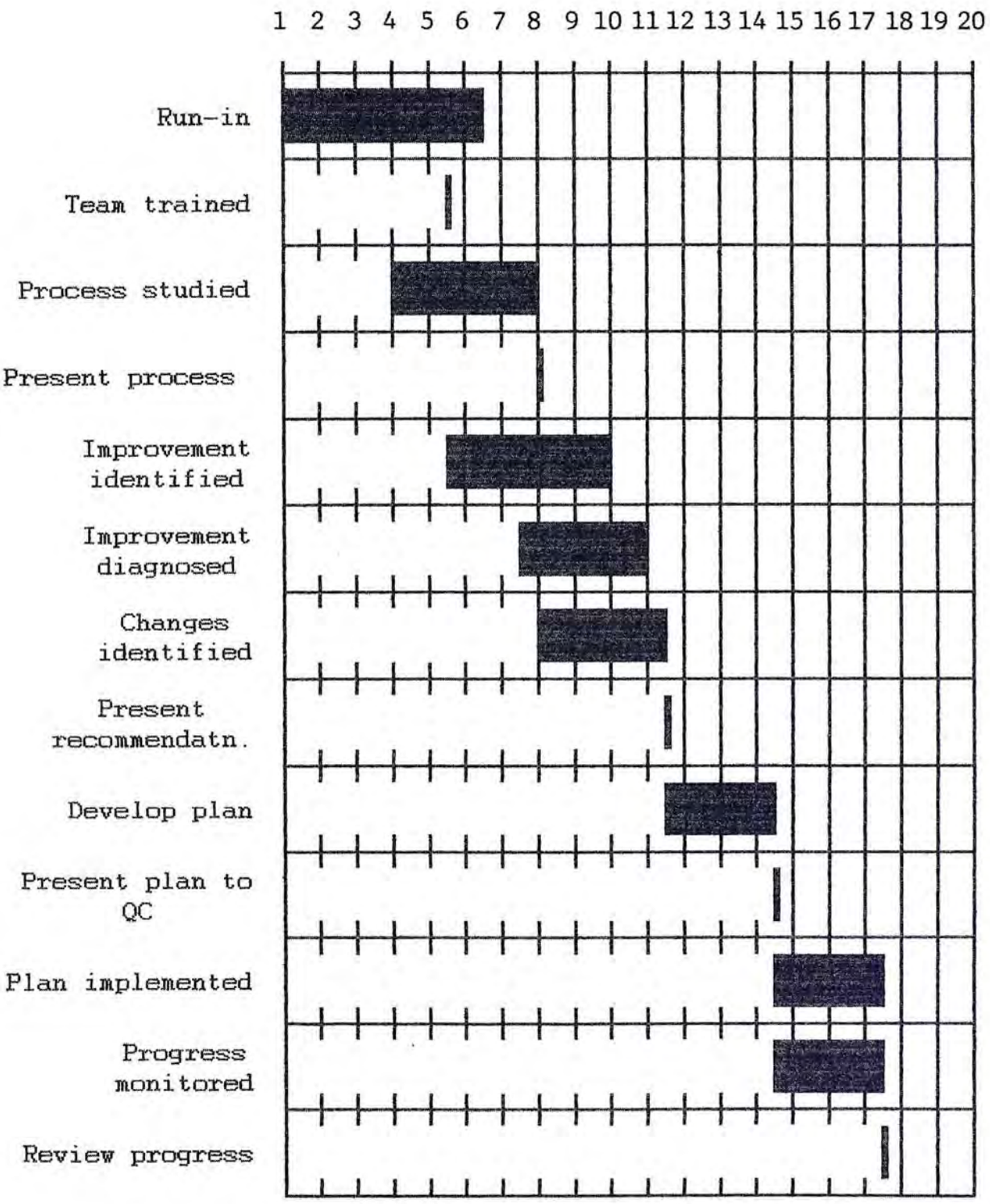
Understand each other's job and problems

Better cooperation

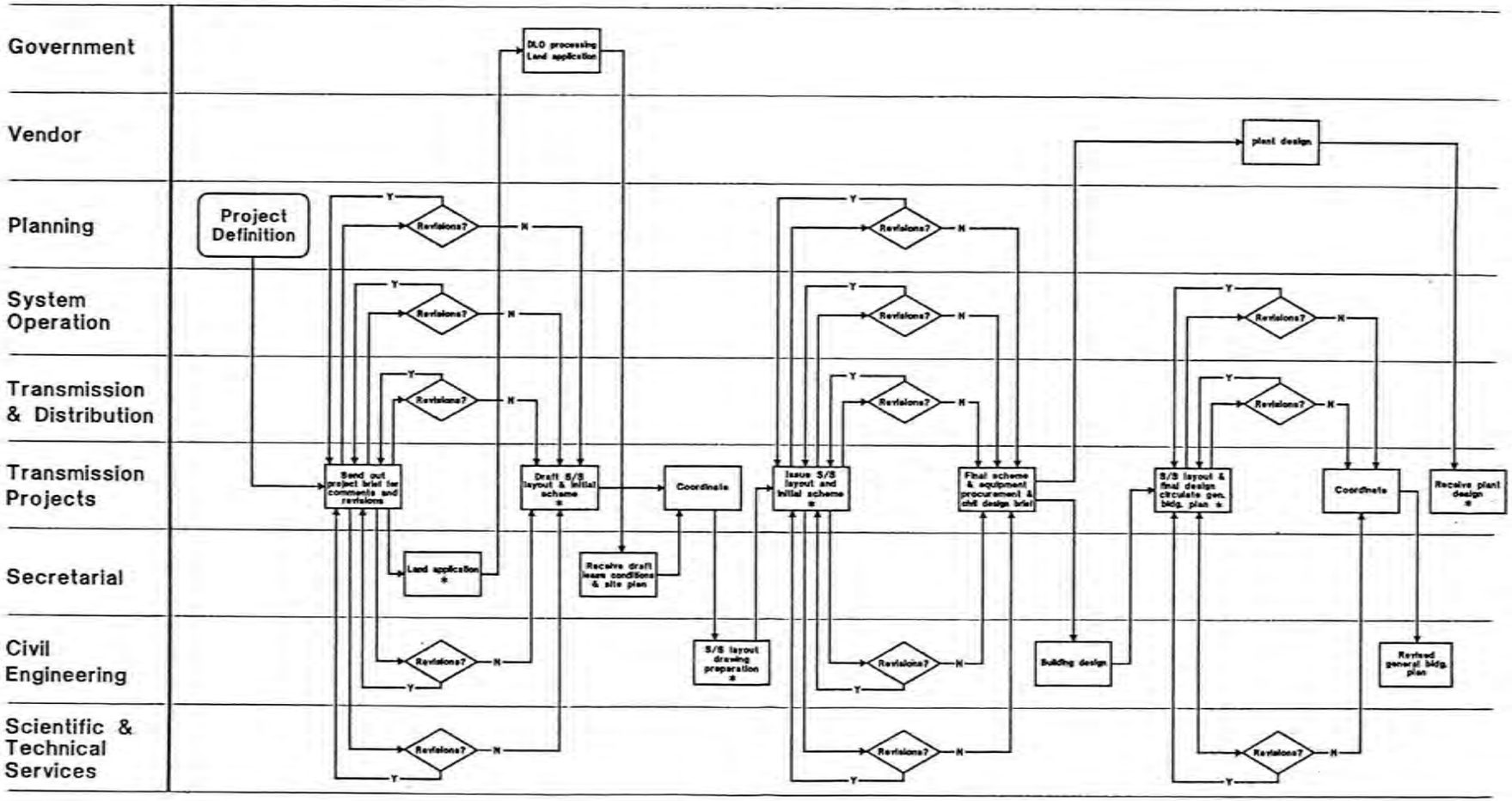
Practice TQM techniques

Challenge and satisfaction

APPENDIX 9 : PROPOSED WORK SCHEDULE OF TEAM

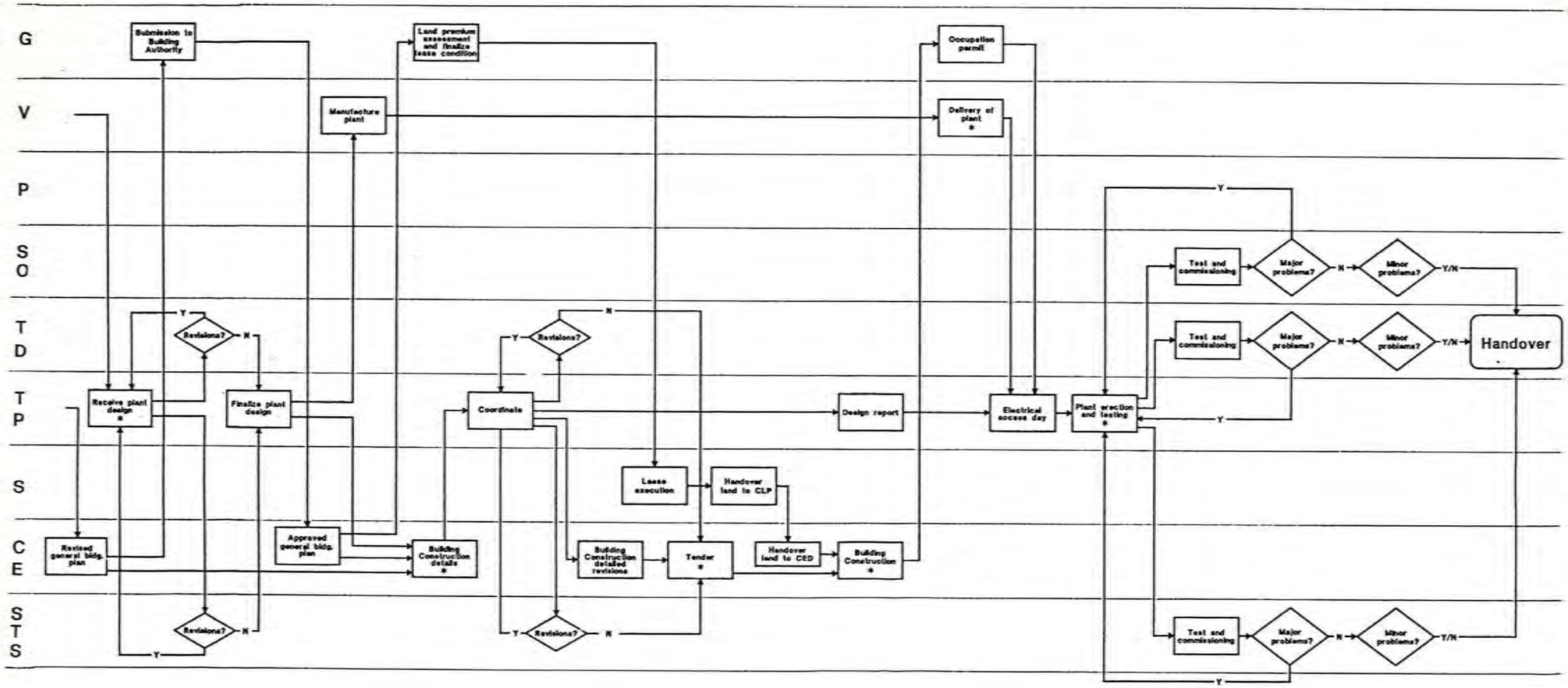


TRANSMISSION PROJECTS PROCESS MAP

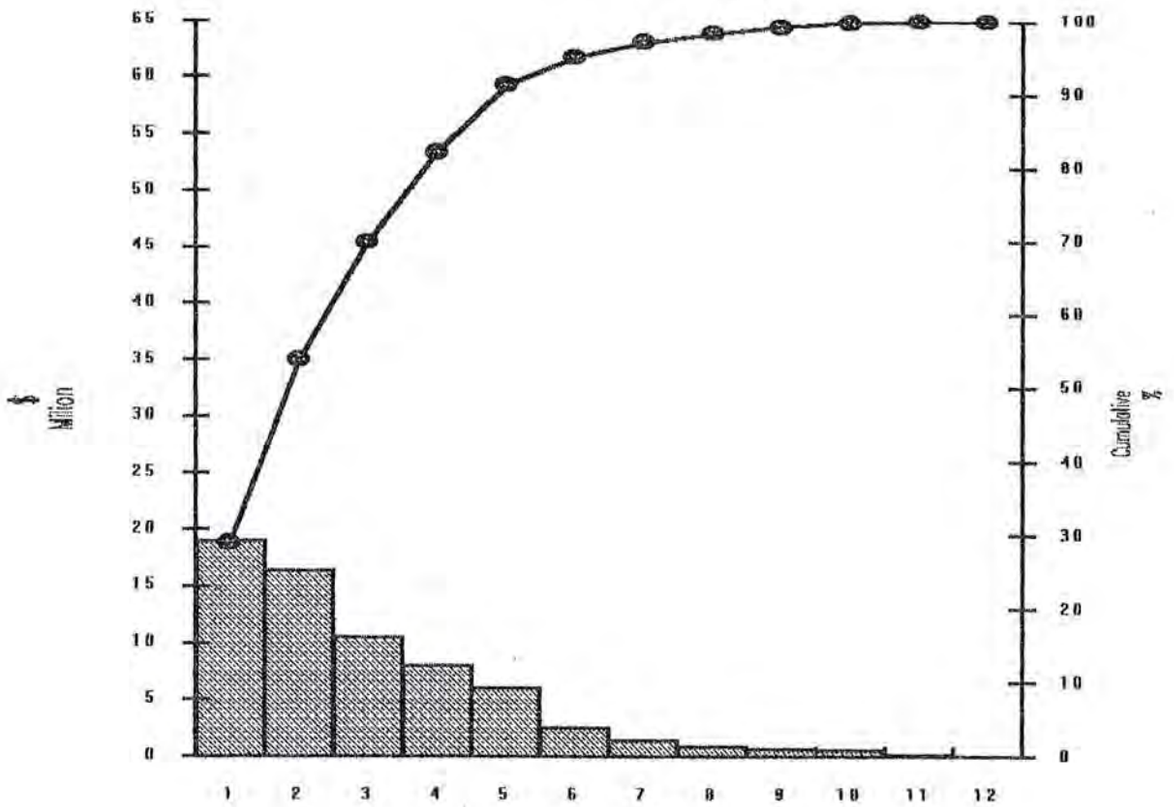


To be continued on next page

APPENDIX 10 : TRANSMISSION PROJECTS PROCESS MAP (Continued)



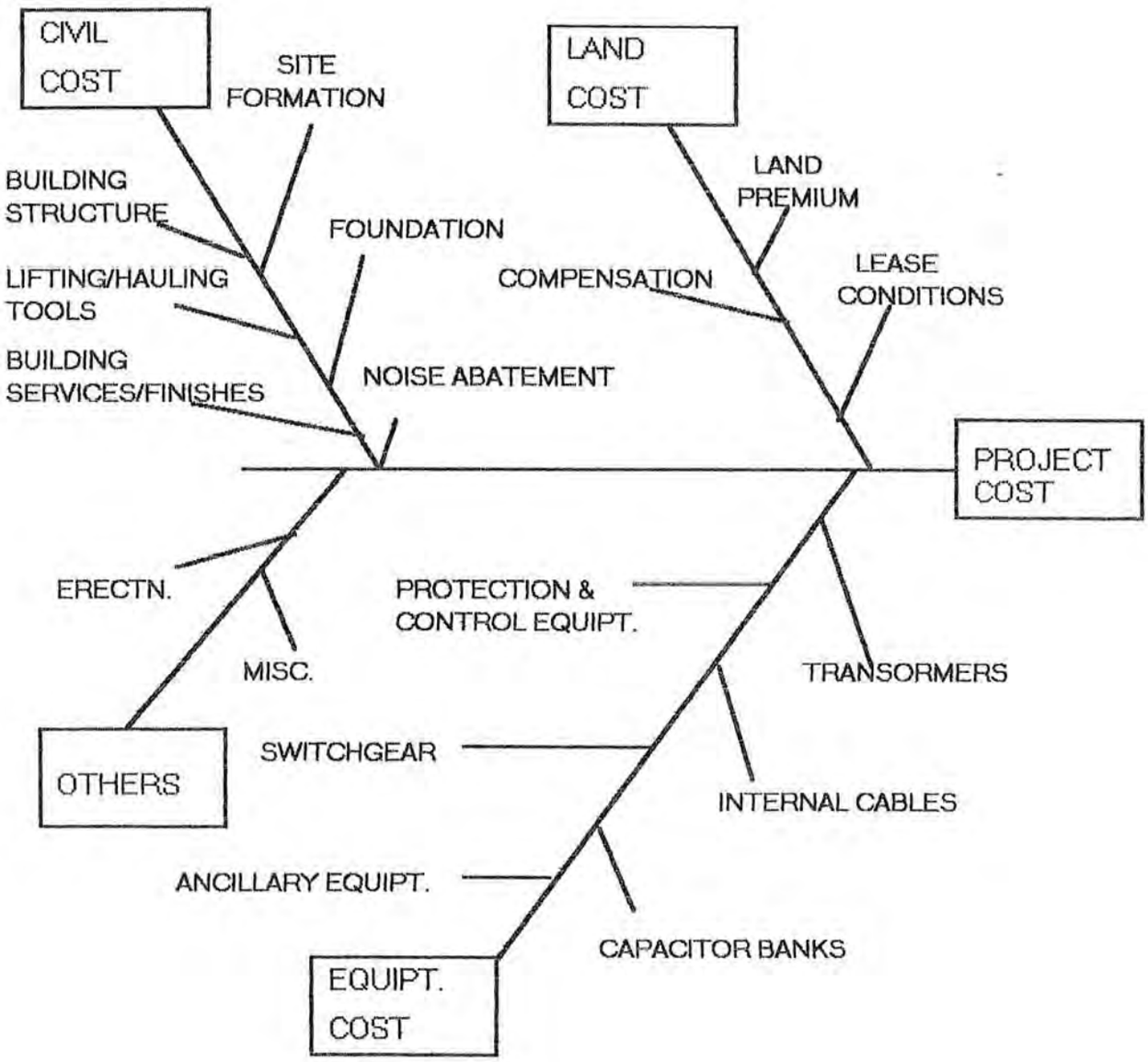
APPENDIX 11 : PARETO CHART OF SUBSTATION PROJECT COSTS



Legend for the cost elements :

1 - Land
2 - Civil
3 - 11 kV Switchgear
4 - HV Transformers
5 - 132 kV Switchgear
6 - Internal Cabling
7 - Fire Protection
8 - Substation Miscellaneous
9 - Capacitor Banks
10 - Telemetry
11 - LV Transformers
12 - Ancillary Equipment

APPENDIX 12 : FISHBONE DIAGRAM OF PROJECT COST ELEMENTS



APPENDIX 13 : POSSIBLE COST REDUCTION AREAS

(A) Land Cost

- I) Land Premium
- II) Compensation
- III) Lease Conditions

(B) Civil Cost

- I) Lifting / Haulage Facilities
- II) Visual Impact
- III) Site Formation
- IV) Noise Abatement
- V) Foundation
- VI) Building Finishing
- VII) Building Structure
- VIII) Building Services
- IX) Building Layout

(C) Equipment / Plant Costs

- I) General
- II) Transformer
- III) Switchgear
- IV) Reactor and Capacitor
- V) Protection and Control Equipment
- VI) Substation Ancillary Equipment
- VII) Internal Cables

APPENDIX 14 : PRIORITIZED LIST OF PROJECT COST REDUCTION OPPORTUNITIES

	Description	Cost	Time	Control by CLP	Ease
1.	Substation layout	H	H	H	M
2.	132 kV RMU located above Tx.	M	H	H	H
3.	Deleting low smoke halogen free multicore cables	M	H	H	H
4.	Deleting / simplifying the standby control panels in 400 kV s/s	M	H	H	H
5.	High rise type 132 kV RMU	L	H	H	H
6.	Substation building internal / external decoration	L	H	H	H
7.	Labour cost	L	M	M	M
8.	Deleting instrument transformers	L	H	H	H
9.	Review Fire Protection Code of Practice	H	L	H	L
10.	Air-conditioning, forced ventilation	?	M	H	M
11.	Location and shape of substation site	H	L	L	L
12.	Review protection requirements / standards	L	L	H	L
13.	Review contract and purchasing policies	?	L	H	L
14.	Review plant specification	?	L	H	L
15.	Negotiate lease conditions with Government	M	L	L	L

H - high (short for time), M - medium, L - low (long for time)

BIBLIOGRAPHY

Books

Cameron, Nigel. Power - the Story of China Light. Hong Kong: Oxford University Press, 1982.

Crosby, Philip B. Quality Is Free. New York: McGraw-Hill, 1979.

Crosby, Philip B. Quality Without Tears. New York: McGraw-Hill, 1986.

Crosby, Philip B. Let's Talk Quality. New York: McGraw-Hill, 1989.

Deming, W. Edwards. Quality, Productivity, and Competitive Position. Massachusetts Institute of Technology, 1982.

Feigenbaum, A. V. Total Quality Control. 3rd ed. McGraw Hill, 1983.

Gabor, Andrea. The Man Who Discovered Quality. New York: Times Books, 1990.

Garvin, David A. Managing Quality. New York: The Free Press, 1988.

Ishikawa, K. What is Total Quality Control? The Japanese Way. (Translated by Lu, David J. and published by Prentice-Hall, N.J. in 1985).

Jablonski, Joseph R. Implementing Total Quality Management. New York: Technical Management Consortium, 1990.

Juran, J.M. Juran on Leadership for Quality - An Executive Handbook. New York: The Free Press, 1989.

Oakland, John S. Total Quality Management. U.K.: Heinemann, 1989.

Shewhart, W. A. Statistical Method from the Viewpoint of Quality Control. Originally published in 1939. (Edited and with a new Foreword by W. E. Deming. Published by Dover Publications, New York in 1986.)

Shuster, H. D. Teaming for Quality Improvement. New Jersey: Prentice Hall, 1990.

Periodicals

Axline, Larry L. "TQM : A Look in the Mirror". Management Review. 80 (Issue 7, July 1991) : 64.

Bowles, J. "Is American Management Really Committed to Quality?". Management Review. April 1992, p.42-46.

Brown, M.G. "Measuring Your Company Against the Baldrige Criteria". Journal for Quality and Participation. 14 (Issue 3, June 1991) : 82-88.

Brown, M.G. "The Baldrige Criteria - Better, Tougher and Clearer for 1992". Journal for Quality and Participation. 15 (Issue 2. March 1992) : 70-75.

Chorn, Norman H. "Total Quality Management : Panacea or Pitfall?" International Journal of Physical Distribution & Logistics Management . 21 (Issue 8. 1991) : 31-35.

Conner, Roy C. Jr. "A Success Formula". Internal Auditor. 49 (Issue 2. April 1992) : 33-36.

Conway, William E. "Quality Management in an Economic Downturn". Quality Progress. May 1992, p.27-29.

Dale, B.G. and Lightburn, K., "Continuous Quality Improvement: Why Some Organizations Lack Commitment?". International Journal of Production Economics. Issue 27. 1992, p.57-67.

Glenn, Tom. "The Formula for Success in TQM". Bureaucrat. 20 (Issue 1. Spring 1991) : 17-20.

Gopalakrishnan, K. N. and McIntyre, B. E. "Hurdles to Quality Health Care". Quality Progress. 25 (Issue 4. April 1992) : 93-95.

Hill, Stephen. "Why Quality Circles Failed but Total Quality Management Might Succeed?" British Journal of Industrial Relations. 29 (Issue 4. Dec. 1991) : 541-568.

Lee, Chris. "The Customer Within". Training. 28 (Issue 7. July 1991) : 21-26.

Miskawi, Z. "An S-curve equation for project control". Construction Management and Economics. Issue 7. 1989, p.115-124.

Porter, L. J. and Rayner, P. "Quality Costing for Total Quality Management". International Journal of Production Economics. 27 (1992) : 69-81.

U.S. Utilities. "Total Quality Management". Public Utilities Fortnightly. May 1992, p.66-73.